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MACHINE DRAWING AND ITS ADVANTAGES.

In our last number we gave some extracts from Prof. CUMMINGS' lecture on the application of the Arts of Design to the Mechanic Arts, for the purpose of showing their importance as connected with elegance of arrangement, &c. We now propose to show the necessity of the principles of a knowledge of isometrical projection, orthographic drawing, perspective, &c. to enable the machinist to construct with economy and certainty, as to relative strength of parts.

Perhaps this cannot be better shown than by a narration of facts which occurred within the last two years. A friend, having occasion for a steam engine, made out a description, detailing sufficient of the minutiæ to receive proposals, and sent copies to several of our largest manufacturers for estimates. On receiving them, to his great surprise, he found their prices to vary as follows: viz. one $5,700, one $3,400, one $2,750, and one $1,600. He then informed the parties offering the lowest estimate, that they were entitled to the work, but that he feared they had made some error in their estimate of the cost; they showed him a drawing accurately made of all the parts, from which, with the assistance of Tredgold's and other tables, they had decided the relative weight and strength of each part, also the probable cost of each separate piece for finishing, &c. and that they were willing to build it; they did so, and produced an ex-

cellent engine, which has operated successfully ever since; and the cost when completed was found to be within $40 of the original estimate of the manufacturer, leaving the profit he claimed for his services. Our friend soon after met one of the parties who had estimated at a much higher price, and was asked who built his engine, and at what price; when told, he said (honestly) "they have lost at least $1000 by it." On being informed that they had made a fair profit, and of the means used to estimate it, he roundly asserted that no man could possibly estimate the weight of each part of an engine by calculation, and acknowledged that he had often both over and under estimated. On being shown how these calculations could be made, and consequently convinced of the fact, he said that he had been twenty years in business, and had never before seen such calculations attempted.

The party who projected the engine had taken twelve lessons in drawing at the Mechanics' Institute, from Mr. P. R. Hodge; and, from a slight application to such abstract mathematical rules as were desirable in his business, had made himself capable of estimating with greater certainty than could be obtained by twenty years experience without such advantages.

By a knowledge of orthographic drawing, the mechanic is enabled to give plans to workmen, so accurate and sufficient, as to do away, in a great degree, with the necessity of his personal presence. An isometrical drawing answers the double purpose of a working drawing and a perspective view, so that the customer and the workman may both be satisfied. A perspective drawing gives a true picture of the machine, as it will exist when finished; which in many cases would secure the work that otherwise would pass to other hands for want of such a picture.

We have often been answered by persons when pressing this subject, *that they had no taste for drawing*; this is a popular error: so far as relates to mechanical drawing, it is entirely a mechanical operation, and may be taught to any person possessing sufficient mind to build a steam engine, in twenty lessons of one hour each. If any of our readers will show a solitary instance of a failure under good instruction, we will freely admit ourselves to

be in error. Add to all these advantages the fact that, with the assistance of a few mechanical books, the inventor may complete his machine on paper, and know to a *certainty* its powers and applicability, without leaving his drawing table; and we are sure none but the stubborn will continue to spend fortunes in experiments which may be definitely decided by a few shillings properly expended.

For the American Repertory.

THE ART OF BUILDING.

BY JAMES FROST.

(CONTINUED.)

No. IV.

Having seen that exceeding light segments of hollow spherical arches, are sufficiently strong to sustain floors and heavy loads, and possess manifold advantages over solid arches, we may assume, that larger segments of similar arches must be much more abundantly sufficient for the purposes of roofs; because the ultimate weight that all segments are capable of supporting, being proportionate to their bases, these larger segments having larger bases, will of course be stronger, and therefore much more than sufficient for the support of roofs; which, unlike floors, have scarcely any load to support beyond their own weight.

In fact we shall find, that hollow spheroidal arches, being incombustible, are impenetrable to heat or cold, of exceeding durability, capable of being formed of any, even of immense magnitude, from valueless materials, easily manufactured; and, although of a texture so light as to be unparalleled in nature or art, yet possessing an ample power of ventilation, as surprising as desirable; hence, then, an amazing economy must result from their application to many useful, important, or magnificent purposes, to which they may be peculiarly or admirably adapted.

The same general remarks may in many cases be extended to other novel forms of arches, of a similar character, hereafter to be described.

Spherical domes, at various times, few and far between, have been used in buildings, more generally for splendor than for utility; hence the useful and economical properties of these and similar arches, remain uninvestigated and unemployed.

Even the spherical figure generally assumed, is practically objectionable, from its tendency (like that of common plain arches) to spring at the haunches; hence, then, in domes expensive bond has been hitherto deemed essential.

But the application of bond in these economical arches is as needless as it is troublesome; it is as extravagant as it is unscientific; for, as nothing can be so desirable as to spare great and useless expense and labor, so nothing can be easier than in this instance to remove the cause for bond and this pernicious tendency of these arches to expand at the haunches; for by commencing the dome at a proper angle with the base thereof, and continuing the dome in the form of an equilibrated spheroid, the tendency to expand and the necessity for bond are both and at once completely annihilated.

As it is most desirable in these researches to obtain a clear apprehension of the great strength and utility of materials when judiciously employed, and to learn how substances, now deemed valueless, may with propriety and economy be substituted for those which are costly; and, as the principal aim of these papers is to advocate such employment, I shall add a note (to avoid ininterruption) exhibiting the strength of a very inconsiderable and natural spheroid fairly tested, in the expectation it will be considered an instructive as well as curious fact.

Now if we examine the properties of a brick spheroid, similarly proportioned, its thickness one foot. its diameter one hundred and thirty feet, its height sixty-five feet, its weight will be about thirteen hundred tons, and it would sustain, exclusive of its own weight, fifteen thousand tons.

As the only load to which it would be subjected is the force of the wind, which would not exceed one thirtieth its sustaining power, this arch would be as unnecessarily strong as unnecessarily heavy, though light beyond example.

And such a building as any solid arch could afford without further precaution, though so over strong to support weight,

would not in this climate be useful, from the extreme variation of temperature within the building.

For of all required good qualities in a building, the prime, the essential object to be sought for, is imperviousness to heat or cold; and happily this most important object may be attained in a singularly easy manner, by the use of much less material of an improved form—by the substitution for this single solid arch, (which would readily conduct heat or cold,) of a hollow arch of double its thickness, but formed of double or triple thin walls at suitable intervals (the inner walls being tubular or hollow) and properly connected by occasional hollow bonding courses, according with the size and quality of the building.

The peculiar value and strength of these arches of double curvature being derived from their form, and their stiffness, or power of retaining their form, increasing in the ratio of their thickness; their strength will thus be increased to the utmost, and at the same time the arches be rendered perfectly impervious to heat or cold. Thus perfection will be obtained with the least possible expenditure of materials of an inexpensive kind; and as these arches require no large centering, (an advantage possessed by no others) but, on the contrary, serving the double purpose of walls and roofs, are susceptible (by a few ingenious appliances) of receiving great and elegant internal embellishment at little cost; thus affording the strongest, lightest, cheapest, and, if required, the most ornamental and magnificent of all uninflammable and economical structures for many private and public purposes.

We cannot help being assured of this economy, by comparing the cost of such an arch with one of the latest modern similar works, the central roof of the Hal au Blé, or grain market, in Paris; the circular inner court of which, 120 French feet, in diameter 131.23 feet, was covered very ingeniously with wood in 1782; was burned in 1802; was roofed in 1812 with a tinned copper hemispherical covering, supported on iron ribs; the weight of metals 280.2 tons, the expense $167.600.

Now a treble hollow hemispherical arch weighing less than 600 tons, would support more than 10,000 tons, and though costing less than one tenth of the expense of the Parisian,

would be vastly more intrinsically valuable, because it would be as perfect a nonconductor of heat or cold, as the other is a perfect conductor; thence an oven in summer, and an ice house in winter, ever uncomfortable in all seasons.

A peculiar and novel advantage in these arches is the unparalleled degree and superior quality of ventilation they will afford without cost or trouble, and with the further recommendation, of being most effectual when most wanted, in the hottest weather. This will become apparent by considering the great space between the external and middle wall, on that side of the building exposed to the sun, as a vast reservoir of heated and rarefied air, having an immense tendency to ascend and to escape from numerous apertures, provided for that purpose externally at the upper part of arch. A continued large stream of air being thus discharged, a corresponding quantity will be exhausted from the interior of the building, through numerous small valves for its regulated emission.

Thus a large volume of heated air being continually expelled by an ascending current within the heated side of the building, a descending current of cool, dry, and pure air will be induced to enter from the shady and cool side of the building (and the coolest, purest, and dryest air is always found at considerable altitudes) to supply the interior of the building, instead of the less pure, warmer, and more moist air, as usually admitted.

Other methods have been pursued to obtain similar results, with what inferior success may be seen, by a comparison of some of the best, as in the Derby hospital, in which fresh air is obtained in warm weather through a long and large underground archway. This in some situations would be noxious, in all inefficacious when much used; for the archway would become warm, and incapable of fulfilling its object when most wanted; hence, air of certain dampness, uncertain purity, and inferior coolness, would be furnished at a certain expense, and inconsiderable quantity, because the exhausting power is feeble or wanting, and the cooling power partial, ineffective, and objectionable.

I have dwelt on this subject fully, because I emphatically believe it would be found practically of immense advantage, to

the inhabitants of hot countries to have their dwellings constructed with hollow walls, and also, all such other buildings as require a cool interior; and by proper arrangements, easily apprehended, by employing the ascending current of air heated within those walls exposed to the sun, to exhaust the air from within the building, and thus inhale from the walls on the shady side of building, the cool and salubrious air floating near the highest parts thereof, whence an ample supply may be procured in a refreshing and luxurious breeze, an advantage and enjoyment hitherto unobtained, and unanticipated; overlooked and therefore unattempted.

Now, a most singular recommendation of this method consists in its economy, for hollow walls will be always as inexpensive as solid walls and frequently more so; and thus sometimes a saving in construction, will accompany the double advantage of intercepting the transmission of heat, and of exhausting and exchanging heated and impure air, for cool and pure air, with a force and celerity, in proportion to its intensity and impurity; and as hollow walls will as effectually prevent the transmission of cold as well as of heat, their general substitution for solid walls, must in innumerable cases, when combined with hollow floors and roofs, be attended with such an equalized temperature as cannot fail to be of infinite advantage to comfort and health, as well as general security against conflagration.

On the construction of hollow walls, I have many important practical observations to remark, and many improvements to notice, on a future occasion; at present we must proceed with our subject, by considering another kind of hollow arch of double curvature, and of the lightest form imaginable, and which will serve the double purposes of walls and roofs, and thus furnish exceedingly inexpensive and incombustible structures, which their great simplicity and easy formation will recommend for many useful and economical purposes.

The plan of these consists essentially of a circular ring A, A, open at the centre (or the centre may be covered with a dome,) or of any portion of circular ring, as B, cut by the radius; and, if so cut, the ends furnished with perpendicular walls.

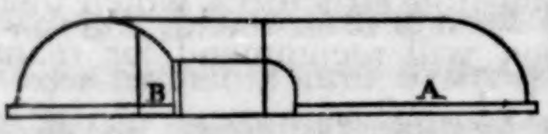
Then if an equilibrated arch, or portion thereof, be built on this circular ring, and forming what is technically termed a circular circular ring, the double curvature thus produced will give ample stiffness to insure the permanence of the arch; even if it be so slight as not to be able to stand alone were it built straight.

Although this kind of arch must be built upon a centre, yet little expense will be thereby incurred; as the arch is so strong from its form, that a small portion may be built at a time on a short centre, which being removed, this small centre will serve to support a large arch or numerous arches in succession.

As buildings of this form may be built with very light tubes or hollow bricks; as such tubes or bricks may be made as inexpensive as common bricks; as hollow arches are as easy of construction as solid arches, and stronger in proportion to the quantity of materials therein; it follows from these data, that temperate, incombustible, and durable buildings may be obtained as cheaply, and constructed as easily, as intemperate, combustible, and perishable fabrics.

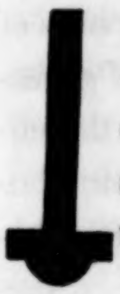
As a full proof that lightness of structure is dependent on skill; that durability is compatible with true economy; that strength depends more on the proper selection and judicious application of materials, than upon their weight or quantity; I have only to adduce and to describe a roof formed of glass and iron, of exceeding beauty, of this peculiar form, in the Surrey Zoological Gardens, London, which exhibits such a perfect combination of strength with lightness, of elegance with inexpensiveness, of utility with durability, as to show most convincingly, how extremely materials may be economized, with good effect and liberality of purpose.

This roof, is about three hundred feet in circumference; the



width of ring about twenty five feet, shown in front at A, in section at B, is wholly roofed with small curved ribs of rolled iron, standing vertically about six inches asunder at the base, and three inches at the top, resting on a low wall in front, upon a high wall in rear, connected horizontally by a few stout iron wire tye rods, glazed with very small panes, each of an elegant segmental form, cut from frag-

ments of glass of little cost, firmly cemented to bars and to each other by overlapping barely one eighth of an inch. They form, with the bars, altogether a firm arch of double curvature, capable of resisting the violence of the wind, impervious to rain, constituting the most commodious, agreeable, and light building imaginable for the protection and display of a splendid collection of wild animals; but adduced here only as evidence of the extreme lightness of structure of an arch of double curvature, for a permanent and extensive building, and as a means of showing what important improvements have yet to be effected in an art, which many who practise complacently assume as all but perfect.



The accompanying section of the arched bars of rolled iron is of the full size; and hence this immense roof of glass and iron may be assumed of the weight only of about three pounds, per supl. foot, or less absolute weight than of the slightest shingled, wooden, commonest shed. A moment's consideration of this fact, in a comparison of the weight and cost of this permanent arch of double curvature, with the weight and cost of any arch of single curvature, must convince every ingenuous person of the infinite superiority of the strength of such forms, and of the secure, profitable, and happy results to be practically obtained by their adoption.

It is as possible to form a straight as a circular building of moderate width, possessing all the advantages of the circular hollow equilibrated arches before detailed, with one small exception and precaution only, viz. the additional expense of small internal or external ribs at suitable distances, to give sufficient stiffness to insure the stability of the arches, with which these ribs, being properly bonded, will form a firm, sound, and unyielding fabric. Thus, another extensive form, a distinct series of novel, useful, and cheap, incombustible buildings, becomes attainable for a multitude of useful purposes.

Series of connected plain arches, adapted to incombustible buildings, surrounding a complete circle, but little known, though sometimes adopted in practice, are deserving of attention, as in some cases they may be advantageously employed alone,

as they have been in some considerable works, in the coast de-

fences of England, arched on walls at A, or in conjunction with a circular covered central roof, with groined arches on pillars, as at B, in the Hal au Blé at Paris, as already described; and, as by continuing the series of arches round the entire circle, the arches abut against each other; and as they may be constructed of any number of stories or floors of arches; and as the upper arches may be covered with slate or composition for roofs, or covered with gravel for a terrace, and as the exterior circular walls will not be required of any particular thickness, this form may be (connected or not with the central dome) employed for many useful purposes of storage, as at Paris, where it forms an extensive series of granaries of the most useful kind. In fact a combination of the circular ring and dome, the ring and dome where meeting supported on a wall, circular on the plan, pierced with large arched apertures, as well as other combinations of these different kinds of buildings, will present themselves in a variety of useful forms to any reflecting and intelligent person.

The rough sketch here attempted, requires much filling up, to be adequate to the purposes intended, of indicating that radical improvement, so immeasurably needed, of one of the most useful arts; and which in its present imperfect condition, is the constant and fruitful source of some of the greatest calamities that afflict and impoverish society. Yet, imperfect as such a confined sketch must necessarily be, in a work devoted and limited to general notices of improvement, I trust to have satisfactorily removed the greatest objections hitherto made to incombustible buildings, by showing that neither enormous sacrifice of space, nor cumbersome walls and arches, nor extravagant cost, is needed; and that all the complicated evils attendant on combustible structures may be easily overcome and at no very remote period be annihilated, while in numerous cases, great immediate profit must result. Perhaps there are few situations wherein incombustible buildings may not be found profitable, and in some instances extremely so as will appear from the following fact.

A merchant has to insure a valuable incombustible stock (and his new fire proof, combustible store) at an annual expense of one thousand dollars; and as the extra cost of a durable and incombustible store would not have exceeded two thousand dollars, and as uninflammable merchandise therein needed no insurance; the saving of the merchant in the first year's cost of his store will be much less than one thousand dollars because he has also been at some considerable expense for that puerile contrivance, a fire proof safe; whence the loss of the merchant will evidently be equal to the difference between the trifling sum saved, and the tax of one thousand dollars yearly, besides the certain losses, crosses, and contingencies attending a future conflagration, against which no insurance ever did or can provide.

ANALYSIS OF SOILS.

BY C. A. LEE, M. D.

In a late "Report on a re-examination of Massachusetts," by Professor Hitchcock, we have noticed an account of a new mode of analysing soils, which is so simple and important, that we are induced to transfer it to our pages. It is the invention of Dr. Samuel L. Dana, of Lowell, Mass.

RULES OF ANALYSIS.

1. "Sift the soil through a fine sieve. Take the fine part, *bake* it just up to browning paper.

2. "Boil one hundred grains of the baked soil with fifty grains of pearl ashes, saleratus, or carbonate of soda, in four ounces of water, for half an hour; let it settle; decant the clear; wash the grounds with four ounces of boiling water; throw all on a weighed filter, previously dried at the same temperature as was the soil; wash till colorless water returns; mix all these liquors. It is a brown colored solution of all the soluble *geine.* All sulphates have been converted into carbonates, and, with any phosphates, are on the filter. Dry, therefore, that, with its contents, at the same heat as before. Weigh—the loss is soluble *geine.*

3. "If you wish to examine the geine, precipitate the alkaline solution with excess of lime water. The *geate* of lime will rapidly subside, and if lime water enough has been added, the nitrous liquor will be colorless. Collect the geate of lime on a filter; wash with a little acetic or very dilute muriatic acid, and you have geine quite pure. Dry and weigh.

4. "Replace on a funnel the filter and its earthy contents, wash with two drams muriatic acid diluted with three times its bulk of cold water. Wash till tasteless. The carbonate and phosphate of lime will be dissolved with a little iron, which has resulted from the decomposition of any salts of iron, besides a little oxide of iron. The alumine will be scarcely touched. We may estimate all as *salts* of lime. Evaporate the muriatic solution to dryness, weigh and dissolve in boiling water. The insoluble will be *phosphate of lime*. Weigh—the loss is the *sulphate of lime;* (I make no allowance here for the difference in atomic weights of the acids, as the result is of no consequence in this analysis.)

5. "The earthy residuums, if of a greyish white color, contain no insoluble geine; test it by burning a weighed small quantity on a hot shovel. If the odor of burning peat is given off, the presence of insoluble geine is indicated. If so, *calcine* the earthy residuum and its filter—the loss of weight will give the insoluble geine; that part which air and moisture, time and lime, will convert into soluble vegetable food. Any error here will be due to the loss of water in a hydrate, if one be present, but these exist in too small quantities in 'granitic sand' to affect the result. The actual weight of the residuary mass is 'granitic sand,' 'the clay, mica, quartz, &c. are easily distinguished. If your soil is calcareous, which may be easily tested by acids; then before proceeding to this analysis, boil one hundred grains in a pint of water, filter and dry as before; the loss of weight is due to the *sulphate of lime*, even the sulphate of iron may be so considered; for the ultimate result in cultivation is to convert this into sulphate of lime."

"Test the soil with muriatic acid, and having thus removed the lime, proceed as before, to determine the geine and insoluble vegetable matter.

Prof. Hitchcock remarks, in a note, as follows: "in applying Dr. Dana's rules given in the text, to the soils of Massachusetts, I found it necessary to adopt some method of carrying forward several processes together. I accordingly made ten compartments upon a table, each provided with apparatus for filtering and precipitations, also ten numbered flasks, ten evaporating dishes, and a piece of sheet iron pierced with ten holes, for receiving the same number of crucibles. I provided also, a sheet iron oven, with a tin bottom large enough to admit ten filters, arranged in proper order, and a hole in the top to admit a thermometer. The sand bath was also made large enough for receiving ten flasks. In this manner I was able to conduct ten processes with almost as great facility as one could have been carried forward in the usual way."

We have no hesitation in commending this report of Prof. Hitchcock, as one of the most valuable which has yet appeared in any country. L.

NEW THEORY OF VISION.

BY DR. WALLACE, OCULIST, N. Y.

From the experiments of Morichini of Rome, and Mrs. Somerville of London, we learn that violet and green light possess the property of rendering steel magnetic, while no effect is produced by yellow or red. If we consider the former colors positive and the latter negative, and if, as Sir John Herschel supposes, there are a number of minute fibres placed at right angles to the coarser fibres of the retina, as the pile of velvet rises from the coarser texture of the woven silk—an opinion which he expressed not long ago in a letter to me—we may easily conceive that the impressions on the retina may be conveyed through the bundles of the optic nerve to the sensorium, on the principle of the electro-magnetic telegraph.

This theory derives plausibility from the fact, that the spectrum, which remains after looking at a bright object, is always of an opposite color; and from some ingenious experiments made by Mr. Newberry, a scientific teacher of drawing, in this city. When light is admitted through blue glass and received

upon a sheet of white paper, the object held before the paper, is yellow. When it is admitted through yellow glass the shadow is blue; when the glass is red the shadow is green; and when green the shadow is red. The shadows of a landscape have a purple hue during a summer's sunset when the sky is yellow.

The brain itself is an electro-magnetic instrument, consisting of a brown and of a white plate convoluted in such a manner that with a great extent of surface they are packed in a very narrow compass. From the white plate proceed numerous conductors twisted round the base, not at all dissimilar to the arrangement of one of Henry's magnets. See Tiedemann's and Spurzheim's plates.

As motion can be effected by transmitting galvanic currents along the nerves which proceed from the brain, there is reason to believe that sensation is produced by similar currents passing to the brain, and that these currents are always changing with the nature of the impression. If the minute fibres of the retina are made positive by blue light, a positive effect will be immediately made at their termination in the brain. If yellow light be then presented, the fibres being negatively affected will assume a different position and thus alter their terminations. All the other colors may produce similar effects, and may be conveyed by their own peculiar fibre contained in the bundles of which the nerve is composed.

SURPRISING STRENGTH OF AN EGG SHELL.

In Lord Brougham's celebrated discourse, on the objects, pleasures, and advantages of science, an interesting description occurs, of the mathematical accuracy and perfect economy exhibited by the bee in the construction of a honeycomb, and showing how superior in those respects are the works of that little insect, to the works of the sons of Adam.

The same exquisite adaptation of means to ends, as superior exhibition of great strength obtained from the least material, is also constantly exhibited for our instruction in those beautiful productions of providence, the shells of various animals, and which, however different their forms, will always be found com-

posed of curves of double curvature, and the great strength of a very fragile and brittle substance of this form, is well exhibited in the shell of a common egg.

These shells vary in weight from ninety to one hundred and ten grains. One, weighing one hundred and four grains, was embedded in plaster, within two copper hoops, which with the plaster were at the distance of one tenth of an inch; pressure being gradually applied by a weighted lever, the shell sustained uninjured seven hundred pounds. Now, as the diameter was $1\frac{5}{8}$ inch, the thickness $\frac{1}{80}$ of an inch, the area subjected to pressure was $\frac{1}{16}$ of an inch, $=11200$ lbs. per square inch, (supported.) The specific gravity of common egg shell is 2.444.

Brick, specific gravity,	1.841	According to Rennie.	is crushed with	562 lbs.
Marble, " "	2.706		" "	6,060
Granite, " "	2.625		" "	10,910

Egg shell consists of a considerable portion of Albumen;
" " Silica, a trace;
" " Carbonate of Lime, about 2;
" " Carbonate of Magnesia, about 1.

The lime having been precipitated by oxalate ammonia, the solution did not become turbid by addition of ammonia; hence, as a copious precipitate of magnesia followed a drop of phosphoric acid, it seems improbable that phosphoric acid was previously present in the shell, as usually stated in chemical works.

The hardness of Italian statuary marble, as tested by abrasion, being..........................	100
The hardness of the external parts of shells, similarly tested, varied from 400 to 450,....average,	425

The hardness of the internal portion of the shell is much less, but yet considerable. If into a shell broken in the direction of its conjugate diameter, another shell be inserted, it will be found to fit accurately in every position; proving the perfect circular figure of each, a mechanical fact truly surprising, when the formation of shell from a fluid within the interior of an animal in frequent motion is considered. It exhibits another proof of the wonderful superiority of the ways of providence above our ways on all occasions. F.

For the American Repertory.

LYCEUM OF NATURAL HISTORY.

PROCEEDINGS.

April. Dr. Jay presented two nuts of a palm allied to the cocoa nut.

Dr. De Kay, exhibited a flounder, in which, contrary to the general case, the eyes were placed on the left side, and both sides were deeply colored. It was considered a remarkable example not only of a doubled, but reversed fish.

Mr. W. Kemble presented, through Mr. W. C. Redfield, a piece of shale, containing several fossil fish, taken from a coal pit near Richmond, Va.

Dr. Torrey exhibited specimens of both the red and white coonti or arrow root used by the Indians of Florida for food. The latter is prepared from the underground stem of the Zamia integrifolia, and the former from a species of Smilax.

Capt. Folkes, of the ship Bertha, presented the eggs of a land shell, (Bulimus ovatus) common in the vicinity of Rio Janeiro. These eggs were laid on board his ship in November 1836, while on the passage to Germany, whither he was taking the shells, to satisfy the naturalists of Europe of the fact of their laying eggs.

Dr. Boyd stated that he had detected our common snail, the Helix alternata, in the act of depositing its eggs, and that he had broken the egg and found the young shell inside.

Mr. W. C. Redfield exhibited two charts illustrating the progress of Atlantic hurricanes; prepared by Lieut. Reed of the British Navy.

The President made an interesting statement relative to the discovery of Silica, in an organized state, in the ashes of plants, by Mr. B. Reade. He also stated that he had found silicious skeletons in the ashes of anthracite coal.

Prof. Bailey of West Point exhibited drawings of silicious skeletons, which he had obtained from the ashes of some confervæ.

The fourth geological report of the state of Tennessee, and the second report of Maine were laid before the society.

Mr. J. H. Redfield presented the palatine teeth of a species of fossil shark, from the carboniferous limestone of Bristol Eng.

A communication was read from John G. Anthony relative to to some trilobites found in the vicinity of Cincinnati, Ohio, which exhibited distinct traces of antennæ. Some fine specimens of chrystalized gypsum were received from Mr. Joseph H. Applegate.

Dr. De Kay presented a piece of sulphuret of copper, in mica slate from North Carolina. He also laid before the society specimens of tin ore; which he had received from the same gentleman from whom were obtained the specimens presented in October last, and who stated that they were procured from the mountains of North Carolina.

A fine coralline, (Fungia) from the East Indies was presented by R. P. Jenks, Esq.

Dr. Gale informed the society that he had recently examined the lignite beds of Amboy, and found several of them under water at the distance of forty or fifty rods from the shore. He also found in the water at some distance below low water mark, several stumps of charred wood, apparently of more recent date than the other deposites.

Dr. Jay presented some very perfect crystals of hornblende and sulphuret of copper, from the East Indies; also, a cast in wax from a specimen of a new genus of trilobites, with a communication from J. G. Anthony, Esq. describing this and another species of the same genus for which the name *Ceratocephala* is proposed.

The Transylvanian Journal of Medicine and Science, vol. 8, and a number of pamphlets, were received from Dr. C. W. Shorp, of Lexington, Kentucky.

The President read a communication from Professor Baillie, of West Point, reporting the existence of a large deposite of fossil infusoria in a peat bog near Fort Putnam, West Point, and describing the same. The paper was accompanied with specimens for the society.

The President stated, that these infusoria were similar, and some of them identical, with the species described by Ehren-

berg in Silesia, and which are found to make up almost the entire substance of the mineral called Tripoli or polishing slate.

Mr. Russell presented specimens of lead ore from the Shawangunk Mountains.

GENERAL SOCIETY OF MECHANICS AND TRADESMEN.

In our last we gave a brief summary of the pecuniary benefits conferred by the society upon the families of its members; and we then adverted to other subjects upon which we had then neither room nor leisure to touch. Among these were the valuable library and the schools of the society; subjects, indeed of immense consequence, since they must very materially influence the principles, the acquirements, and the future fortunes of those who have opportunity to avail themselves of such advantages. We therefore now subjoin briefly from the late reports, the condition and prospects of these two valuable departments.

Library. At the commencement of the present year, there were the following amounts of books in the library; all or most of which have been selected with anxious care, as adapted for the practical use of the apprentice and student, in the wide range of Mechanic Arts.

Volumes in folio, - - - - - -	90
" quarto, - - - - - -	193
" octavo, - - - - - -	2669
" duodecimo, - - - - -	8107
Total,	11,059

That these volumes have not remained "sealed books," in the hands of the librarian, may be gathered from the pleasing fact that there are 1864 readers; and that during the course of the year 1839, these readers have taken out of the library no fewer than 42,037 volumes, for perusal, being an average of more than 22½ volumes each, and being likewise an increase over the preceding year, of 5167 volumes. The expense of this department for the year 1839, has been $1230 70.

Now when we consider how small a portion of time young mechanics have in their power to devote to reading, after going through their daily occupations, and taking the necessary re-

flection and recreation, it is truly admirable to note the impulse that has been given to useful inquiry, and the patient perseverance with which these young persons have pursued the search for information. Two or three and twenty volumes of useful matter, well digested in the mind, furnish not only a large annual acquisition of knowledge *directly*, but they lay the foundation for a still larger amount of inquiry, the ramifications of which we cannot trace, but they *must be* for good in the main.

SCHOOLS. The summary view of this department for the year 1839, must be pleasing to every friend of humanity and lover of cultivated intellect. The report states that, in the past year

The whole number of male pupils was...........	279	
Average attendance during the year.............		245
The whole number of female pupils............	240	
Average attendance..............................		220
	519	465

Of this number 70 are educated gratuitously, the remainder pay at a low fixed rate, as we have formerly described. In the two departments there are seventeen teachers employed, and the total expense of the schools during the past year has been $10,538 33.

We need scarcely express the pleasure we shall have in following up such statistics as these, whenever we shall have opportunity.

We cannot on this occasion, refuse the tribute of admiration to a sister institution, the Mercantile Library Association, reflecting as we do on the conduct of so large a portion of the young mon of our city, who, disdaining the idle and mischievous dissipation incidental to a large and metropolitan emporium, voluntarily collect themselves into a society, establish sage laws for its government, supply themselves with an extensive library and reading rooms, form valuable lectures for their general improvement during the long evenings of winter, form classes among themselves for the enlargement of scientific knowledge; and all this in the very teeth of incitements continually before

them, which only their own will and sound judgment resist, and in many of which they might participate without being exposed to the animadversion of the world. This institution is indeed, one of which any city in the world might be proud.

[For the American Repertory.]

NATIONAL ACADEMY OF DESIGN.

A meeting of the council was held Monday evening, March 16th, at the rooms of the institution, Clinton Hall, for the purpose of deciding on the merits of the drawings offered for the premiums in the "Life" and "Antique" Schools, and for distributing the rewards to the successful students.

After the decisions were made, the president in council offered a few complimentary remarks, on the gradual improvement manifested by the students, and the benefits arising therefrom, through the influence of the schools, and concluded by requesting, as a mark of approbation, that the drawings which obtained the premiums be placed in the rooms of the Academy during the ensuing year; after which the result was made known, and the premiums awarded in the usual manner, as follows:

In the Life School.—The large silver palette for the best drawing in black and white chalk from the "living" model, to Mr. Jeremiah Nims.

The small silver palette, in the same class, for the second best drawing in black and white chalk from the "living" model, to Mr. S. R. Fanshaw.

In the Antique School.—The large silver palette for the best drawing in black and white chalk from the Venus de Medicis, to Mr. W. J. Bolton.

The small silver palette, in the same class, for the best drawing in black and white chalk, from Hudson's anatomical figure, to Mr. F. E. Jones. C.

[For the American Repertory.]

MECHANICS' INSTITUTE.

CONVERSATIONAL MEETING.

Subject—*Iron Ships.* Many interesting facts were stated in relation to the subject before the meeting. In Great Britain and on the continent, public attention seems to be rapidly awakening to the importance of this species of naval architecture. In England especially, quite a number of iron ships have been constructed, and of various sizes and tonnage. The largest ship of this material, hitherto attempted, is now building at Bristol, Eng. by the Great Western Steam Company. "This vessel is to be three hundred feet long by about forty-five feet wide, and thirty deep. Her keel plate is one inch iron, and the others of five eighths, with double rows of rivets. The ribs are of angle iron, rolled on purpose, and are placed at eighteen inches apart. She will have a very beautiful bow. Her midship section is on the French principle laid down in 1790 by Romné."

"The cylinders of the engines are to be of one hundred and ten inches diameter, and eight feet six inches stroke. Each engine of five hundred horse power. The boilers are made in three parts." [Lond. Mech. Mag. Feb. 1840.]

In England the comparative cost of iron ships is less than those of wood; and it was stated that, for an iron steam boat built by the West Point Foundry Association in this city in 1838, the additional charge over and above an estimate for building the boat in England, was only so much as it would have cost the owners to get the hull from thence into our waters. This boat was 110 feet long and 22 feet beam; the ribs were of wrought iron, made the full length and bent to models. She was covered with rolled iron of five thicknesses to the inch; the fore and aft seams were lapped; the thwart-ship seams were butted and double riveted to the ribs. The work was mostly performed by boiler makers, and although with the use of some additional machinery to that required for engine boilers, yet not necessarily so. The Association is ready to take a contract for building a boat of any required size.

Iron steam boats are much to be preferred for navigating the

Mississippi and the rivers emptying into it. The snags, sawyers, bars, and other impediments to the safe navigation of these waters, are almost harmless to an iron hull. And *all* danger to *life* from these causes may be avoided, by an easy division of the hull into water tight compartments, as in the case of the Valley Forge, an iron vessel now navigating the Ohio. Even should the hull of such a vessel be penetrated by a snag, the dision broken into would be the only one affected.

Ships constructed of iron are less liable to suffer from the ordinary perils of the ocean; their seams are not so likely to start while laboring in a gale; vermin, those sometimes formidable occupants of a vessel, can do no injury to the hull; even a lee shore, commonly so much an object of dread to the sailor, loses part of its terrors when encountered by an iron vessel. It was stated that the two steamboats, one built of iron, the other of wood, taken out by the Landers in their last expedition to Africa, encountered on the passage to the coast a thunderstorm, and that they were very differently affected by the electric fluid; the wooden vessel was struck three times by lightning and much injured, while the iron vessel did not receive the slightest damage.

It was supposed that iron vessels would be preferable for the navy. First, because they are, as sailors call it, *limber*, that is, possess a lithe or pliant property that adds to the speed of a vessel; and again it was alleged that a ball striking the hull from any direction oblique to the surface would be likely to glance from it.

" There is now lying at Greenock (Scotland) a very beautiful iron steamer bearing the name of " Nemesis." She is fitted up with one engine of 120 horse power, and armed with two 32-pound carronades, the one fore and the other aft, which move on solid swivel carriages. Her draught of water is under four feet. Her crew will consist of 40 men. She will, it is said, clear out for Brazil, but her ultimate destination is conjectured to be the eastern and Chinese seas."—*Edin. Obs.*

In answer to a question as to the effect of an iron hull upon the compass, a member stated that a method was known and used in England, for obviating any difficulty which might arise from that cause, but it had not yet been made public.

IRON SHIPS.

New-York, March 24th, 1840.

JAMES J. MAPES,

SIR: In compliance with your request, I give you below a statement of such facts, as have come to my knowledge connected with the use of iron boats in this country.

I think it is now about six years since the first iron steam boat was imported from England by a steam boat company at Savannah. This boat was fitted together in England, and sent out in pieces, the necessary tools and workmen being sent with it, to set it up and put it in operation, which was done at Savannah. Subsequently to this, the Savannah Co. imported and put in operation in the same way, one or two other iron boats.

The last iron boats, imported in sections, were two brought out last year for a company in or near Savannah, and were set up and put in operation at Baltimore, not however by workmen sent from England, but by Messrs. Watchman & Bratt, of Baltimore, the engines for the boats being also built by them.

There was also an iron boat imported into New Orleans last year. This I think was a canal boat to ply on the New Orleans and Pontchartrain canal.

The Robert F. Stockton, whose recent daring passage of the Atlantic has made her so well known, is an iron boat, 70 ft. length, 10 feet beam, and moved by Erickson's Patent Propeller. She is of 30 tons burden, and was intended to ply on the Delaware and Raritan canal, but was I believe found to draw too much water for this purpose. She is now in use on the Delaware river as a tug.

The first iron boats wholly constructed in this country, were built in the western part of this state in the year 1835 or 36, for an opposition line of packet boats on the Erie canal, between Rochester and Buffalo; and as they had a less draft of water than the wooden packet boats, they were enabled to beat the latter from one to four hours in running the whole distance.

The next boats built here, of iron, were those used by the Transportation Lines between Philadelphia and Pittsburg, in 1837. They were built very light for plying on canals only, and were in several distinct sections; which sections were so

made, that when connected, they formed a complete boat; and when the boat arrived at the junction of the canal and railroad, each section was hoisted up, together with the merchandise it contained to a railway carriage, and transported across the mountains, and again replaced in the canal. In this way none of the freight was disturbed until it had arrived at its destination.

Some of the boats built for this route were whole, and not in sections, as above described.

In the summer and fall of 1838, an iron steam boat, with engines, cabins, &c. complete, was built in New-York by the West Point Foundry Association.

This was a twin boat, of 110 feet in length and 23 feet beam, each boat being 7 feet beam. All the rib, angle, and plate iron, was rolled to order at the Ulster Iron Works, and the boat was riveted together complete in New-York, except in four of the thwart-ship seams, which were left unriveted, so as be able to send it out to New Orleans, (for which place it was built) on board ship.

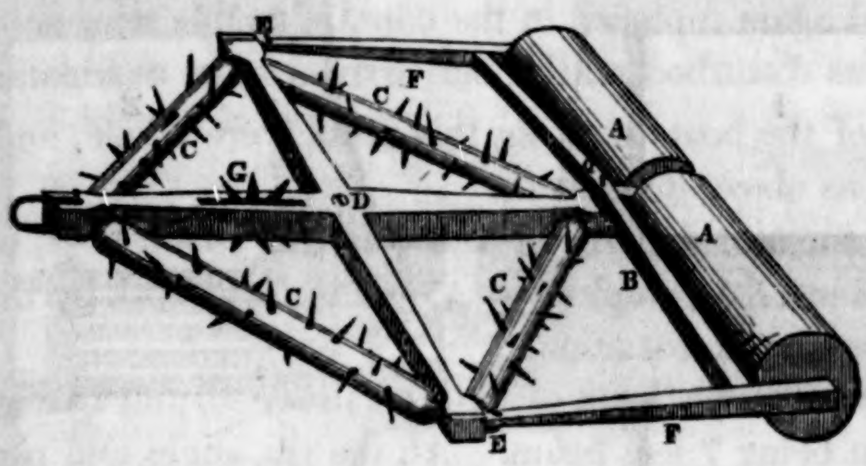
The engines were two, of 14 horse power each, with two cylindrical flue boilers. By the contract entered into on the part of the West Point Foundry Association, the draft of water was guaranteed, with wood, water, and passengers on board, not to exceed 24 inches; and the speed to be equal to 9 miles per hour. When the boat was put in operation, the draft of water was found to be, with wood, water, and passengers on board, 22 inches, and the speed between 11 and 11½ miles per hour. This boat was to ply as a mail and passenger boat on the canal between New Orleans and Lake Pontchartrain.

The last and largest iron boat built in this country was built at Pittsburg in the summer of 1839: it was called the Valley Forge, and commenced running on the Ohio and Mississippi rivers in the fall of the same year, and has proved upon trial perfectly snag proof. The tonnage of this boat is from 300 to 400 tons.

With the hope that this brief description will be of *some* service in calling attention to a subject whose importance has long since ceased to be doubted by practical engineers.

I remain, yours, respectfully, C. W. C.

Report of the Committee on Arts and Sciences, of the Mechanics' Institute, on the Revolving Diagonal Harrow, by MOSES G. CASS, *Utica, N. Y.*



C, C, C, C, are revolving cylinders working in the frame D, by means of gudgeons placed in the ends. Each cylinder is charged with teeth placed perpendicular to the axis, as seen in the drawing. G is a toothed wheel intended to break up the ground that would otherwise be passed over untouched; being under the lengthwise rail of the harrow. B, E, F, a moveable frame supporting the rollers A, A, which may be attached to or disconnected from the harrow at pleasure.

An examination of this machine, and a little reflection will serve to show its superiority to the ordinary harrow. In its passage over the ground the teeth enter the earth in all directions, breaking, removing, or tearing up all slight obstructions; while if it meet with a large stone or any obstacle that would throw the common harrow out, the cylinder, which in this machine encounters the obstruction, is enabled by a whole or partial revolution to pass over it.

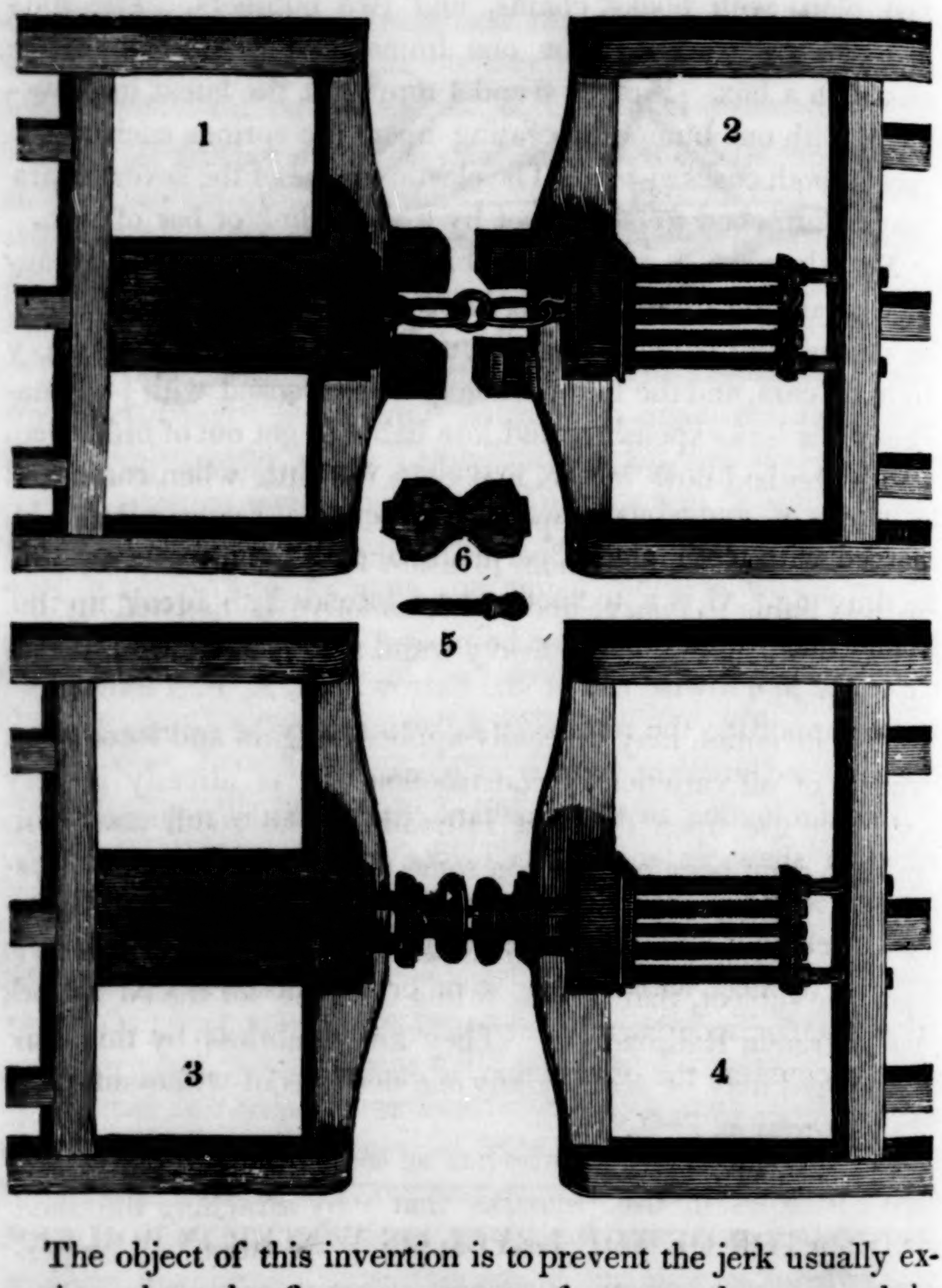
An experienced farmer, who has for some time had one of Mr. Cass's harrows in use, remarks that "by attaching the seed sower and rollers, a most perfect finishing operation will be performed, and at a saving of one half if not three fourths of the labor commonly required to do the same work."

All which is respectfully submitted.

WILLIAM A. COX, *Chairman.*

Mechanics' Insiitute, February 18th, 1840

P. ALVERSON'S PATENT SPIRAL SPRING DRAFT FOR RAILROAD CARS.



The object of this invention is to prevent the jerk usually experienced on the first movement of connected cars, and the shock occasioned by the concussion when suddenly stopped. It consists in interposing elastic chains or spiral spring drafts on the front and rear of each car connected with others in the train.

The drawings at the head of this notice represent the action of the springs in two modes. When used with one bumper,

which the inventor prefers, the drafts are made to operate each way, to soften the jerk of the forward motion, and also by reaction to check the recoil. Figures 1 and 2, represent the first plan, with hooks, chains, and two bumpers. The rods and springs are shown on one frame, and on the other enclosed in a box. Figures 3 and 4 represent the latest improvement, with one bumper operating upon the springs each way; cars in both cases at rest. The elastic chains of the several cars may be attached to each other by a single link or bar of iron.

Mr. Alverson, in speaking of his invention, says "the advantages resulting from these last improvements are that the elastic or spring draft is made to operate easily with a light or heavy train of cars, and the bumpers may be dispensed with; the machinery is less expensive, and less liable to get out of order than in any method now in use, and costs but little when compared with its advantages; the operation is steadier, is attended with less noise, and is much more pleasant for passengers; the cars are less liable to injury, and the locomotive is assisted by the spring draft in starting a heavy train, and also while running on the road."

This invention may be easily applied to cars and locomotive tenders of all varieties of construction. It is already in very extensive use upon different railroads in the south and west, and has even been adopted on some of the Austrian and Russian railroads. Mr. Alverson, who by the way is a resident of New Haven, Conn. informed us in his last communication upon the subject, that he was fitting up some for the New-York and Harlaem Railroad Co. They are doubtless by this time in use, and may be seen by any one desirous of witnessing fully their operation.

INDICATOR OF THE LEVEL OF WATER IN BOILERS.

This is a new application of an apparatus familiar to most engineers. It has occasionally been attached to the supply cock of a steam boiler, to render it a self-feeding one, but the difficulties which lie in the way of its use for that purpose, have caused it to be abandoned.

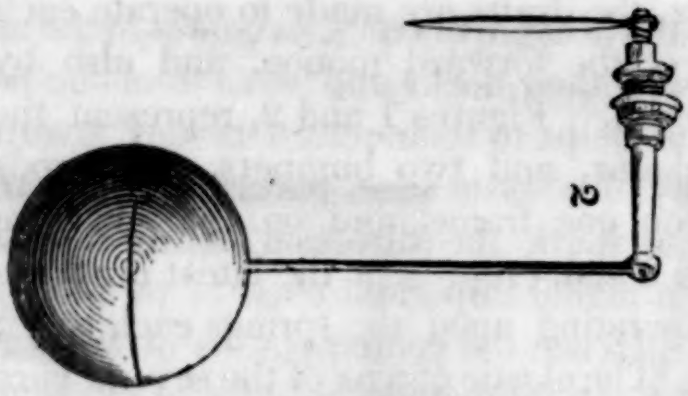


Fig. 2, represents the entire apparatus; a hollow ball of copper, air tight, attached to an arm passing through the head of the boiler; this arm having on its exterior end an index, that by passing over a graduated plate indicates the quantity of water in the boiler.

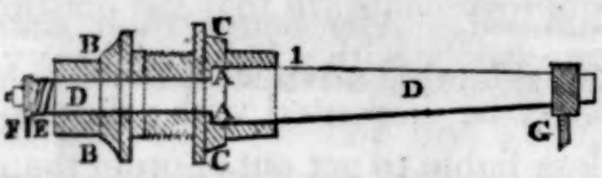


Fig. 1 is a cut section of the arm and its connections. D, the arm, passes through a case B, inserted in the boiler head; this case is secured and the joint made steam-tight by means of the nut C. The arm within the case has a shoulder ground to a face, A, A, forming a valve which is kept perfectly tight by the action of the spiral spring E. G, is the connection of the ball with the arm. F, that of the arm with the index.

This instrument is for sale by Charles W. Jewell, No. 134 West street, New-York.

LECTURES AT THE MECHANICS' INSTITUTE.

We proceed to notice another of the lectures which have been given at the Mechanics' Institute; it was given by Mr. A. D. Paterson of this city, and as connected with commerce, the support of America's Independence and of her national dignity, it may be worthy of the attention of our readers. The subject was "the origin, progress, and present state of Geography," a theme capable of great extension, and in fact, being from that cause, divided into two parts, we cannot give more than a summary notice of the points brought under consideration.

The lecturer commenced by pointing out that Astronomy was antecedent to Geography, as a study of mankind, and he accounted for it from at least two remarkable causes, the one the result of leisure, the other of necessity. Thus the early nomadic state of mankind on the plains of Chaldea and Mesopota-

mia, induced attention to the heavenly bodies, as guides in the migrations of those people with their flocks and herds from one fertile spot to another, and as helps to their return to any favorite sojourn. They were, by this assistance, particularly by the pole star, enabled also to mark the direction of their route from or towards wells; a highly important class of property in those times and regions. Hence the contemplation of the starry heavens gradually led to an intimate knowledge of the several magnitudes, relative positions, distances, and other phenomena which could not but ensue from the earnest and continuous examination which was thus induced. Astronomy from such causes must have made very considerable advances, even as a regular science, before the deluge; and indeed, there are remains of antediluvian astronomy, which attest that those extreme ancients had made important progress therein.

The second of those causes above alluded to, was one originating in necessity, and is to be found in the history of the early Egyptians. The people of that country would be naturally anxious to arrest the progress of the mischief which annually befel them, in the inundation of the Nile; and, as has been the case with mankind in all ages, to turn even an apparent curse into a blessing. To effect so desirable a purpose, it was necessary to find a monitor competent to apprize them betimes of the approach of their formidable enemy; and this at length was found in the rising of a particular star. When that period arrived they were admonished to secure their possessions from the raging of the torrent; they even began to set up embankments, so as to restrain the flood for a while; they formed sluices for the gradual and innocuous admission of the waters; ditches, drains, and water courses were progressively introduced over the face of the country, and the once dreaded Nile became the most powerful auxiliary towards the wealth and happiness of Egypt. Astronomy therefore became a study all-important there as well as in Chaldea; and as a knowledge of the heavens imparts confidence in our wanderings over the earth, so therefore did mankind feel now more emboldened in prosecuting journeys to distant places, and were induced to draw out the rudiments of Geography.

The lecturer here availed himself of the position which he had taken on the Egyptian hypothesis, to point out the probable origin of geography in India, China, and among the earliest American inhabitants. He urged, that, by a parity of reasoning, the people at or near the mouths of those great rivers which were periodically swelled by the mountain torrents so as to become dangerous to life and property, would earnestly investigate the geographical means in the courses of those rivers, in order to restrain, if not to subdue their sweeping impetuosity, and render them if not practically useful, at least harmless, in their sublime career.

In pursuing his investigations, Mr. Paterson advanced the opinion that very little was known of geography, as a practical science, before the expedition of Alexander the Great. It was true that both Pythagoras and Herodotus had travelled much, and noted well what they saw; but their remarks were incidental and methodical; Xenophon also with his ten thousand Greeks, in their famous retreat, stepped over a large portion of the earth's surface; and that great captain made useful military observations, which were afterwards turned to valuable account by Alexander, who probably availed himself much of them in his subsequent Asiatic undertakings. There was, however much valuable matter extant, even in the time of Alexander, which only needed to be collected and methodized to become the foundation of a geographical system; but unfortunately such a collection in those times would have been a difficult task.

The lecturer now points out the first treatise directly and decidedly geographical, that was given to the world. This was by order of Alexander the Great, who throughout the whole of his brilliant but brief career, had shown himself anxious for the cause of science, and who had taken with him two distinguished mathematicians, whose exclusive duties were those of geography. When this "conquerer of the world" resolved to retreat westward upon his own footsteps, he sent one of his captains, *Nearchus*, down the Indus, with orders to sail westward through the Arabian sea, and join the main forces of the Macedonian prince by way of the Persian Gulf. This was done, and the details of the voyage were carefully noted. The lec-

turer considered this treatise a nucleus around which all subsequent geographical works were formed.

But the true "father of geography," the lecturer considered to be Strabo, who did not flourish till the reigns of Augustus and Tiberius. This great man was able to examine and compare a large collection of matters connected with his subject and from them to draw out Geography into a practical science approximating, at least, to truth. To this end he had, besides minor accounts, those of Pythagoras, Herodotus, Hanno the Carthaginian, Polybius, Xenophon, Diognetus and Beton the geographers of Alexander, Nearchus, &c. &c. His own attainments in astronomy and the sagacity of his judgment effected a stable foundation for the science to which he devoted himself; but it was not till long after his time that a substantial superstructure was raised thereon. Ptolemy the astronomer, Pliny the naturalist, Vitruvius the architect, and Arrian the historian, all did somewhat for the advancement of geography; but the dark ages approached, the Barbarians overran Italy and all the civilized portions of the Roman empire; arts, sciences, books, instruments, all were overwhelmed in the torrent of fierce and rapacious adventurers, who treated with contempt, or worse than contempt, every thing that was not martial in Europe. It appears, however, that the Chinese, the Hindoos, and the Arabians continued to make progress in geography; and the works of the last were mainly instrumental in the recovery of that science when brighter days began to dawn on the European continent.

The lecturer observed that one of the most important benefits, both to the subject of his discourse and to civilization generally, resulted from those fanatical expeditions called the Crusades. He showed how bringing together an immense concourse of people from different and strange nations produced a collision and comparison of opinions, habits, and capabilities. Important information was exchanged, and laudable curiosity was excited; interchanges of communication and of trade took place; and mankind found themselves insensibly wiser, and consequently less presumptuous than before. On the other hand much valuable information on science was gained from the

foe whom they came to conquer; and although they reaped but a barren reputation by their arms, they acquired treasures of knowledge which will not pass away so long as the world shall endure. The Crusades moreover brought into notoriety and subsequent greatness the Italian states of Venice and Genoa; the former of which became the carrier of stores to the christian armament and the sole traders with the east by way of the Red Sea; the latter not to be left behind, carried on a trade with the east also, by way of the Persian Gulf and across Syria. Towards the close of the 13th century, a Venetian named Marco Polo traveled extensively in the interior of Asia, and subsequently gave his valuable remarks to the world upon China, India, and the Indian Isles, and much of the eastern parts of Africa, until then little known. He it was who incited to that India trade, which has ever since been of such immense importance to the commercial world.

That which gave to geography a new and magnificent continent, took from the Venetians and the Genoese their important traffic,—the discovery of the polarity of the needle. By its aid Columbus dashed fearlessly over the waves of the Atlantic and discovered America, with its exhaustless treasures of good for the wants of mankind, social and civil liberty being among the best of them, although then but latent in her bosom. Impelled by his example Vasco de Gama persevered in a hitherto hopeless course, made his way round the "Cape of Storms," but henceforth to become the "Cape of Good Hope," reached India by way of the ocean, and turned the great tide of commerce from the Italian republics for ever, to enrich, for a while, the enterprising Portuguese, but to draw thence, as to a common centre, all the enterprising spirits of the civilized world, to that universal mart.

From this time Mr. Paterson observes, there was no further ground for complaint, concerning the slow progress of geography. That most wakeful spirit of human nature, cupidity, was abroad; in many instances accompanied by curiosity, love of science, an adventurous feeling, religious enthusiasm; all, however, lending additional stimulus to desire, and the whole world became quickly overrun, after the Atlantic had been

crossed, and the nautical passage to India had been effected. Accounts of voyages and travels were daily multiplied. Vespucci followed hard upon Columbus and gave America its name; Balboa reached Peru and first saw the waters of the Pacific; thus convincing himself that he was not, as he imagined, in farther India, but that there was still a wide extended ocean to cross. Cortez conquered Mexico and extended his arms along the western frontier of the American continent; Ximines, one of his pilots, discovered California; Magelhaens passed through the straits which bear his name and entered the great Pacific ocean; he had the misfortune to be cut off, but his ships completed the first circumnavigation, although that honor is ascribed to Drake the British navigator. With the latter there appeared a whole host of nautical travelers, and the great oceans of this globe soon became generally known.

The lecturer here took a rapid view of the travels and discoveries by sea and land, of the most distinguished persons who have done service to geography, including the Cabots, father and son, Wallis, Cook, Anson, Byron, Vancouver, Owen, Parry, Ross, Bruce, Park, Denham, Bowditch, Laing, Tucker, Clapperton, and various others; from thence he speculated on the "north-west passage," took a cursory glance at the Danish claims to early American discovery, remarked on the improbability of a new southern continent, and wound up his lecture by a comparison of the information now possessed on the subject of geography with that which was known in the time of Strabo. He concluded with a few pertinent remarks on the advantages morally and socially, independently of those in a worldly view, which result to mankind by the extensive diffusion of geographical knowledge, and on the great improvement in practical science, and mechanical skill which have been the effect of carrying out the enterprises to which the advancement in geographical information gave rise.

ORAM'S COMPRESSED FUEL.

It will be remembered by the reader, that our last number contained the results of some experiments made at the Wool-

wich dock yards with several kinds of fuel, among which was an improved fuel discovered by Thomas Oram, of the county of Middlesex, Eng. The decided advantages of the patent fuel over all others used in the experiments referred to above, render it desirable to know its composition and the process of manufacturing it. These may be gleaned from the following extracts from Mr. Oram's patent.

The materials employed by me are first, small or dust of bituminous coal.

Secondly, mud, alluvial deposits, marl, clay, and other earth, containing vegetable matter.

Thirdly, water; and there are several other substances which may, under certain circumstances, be employed with the above three, but are not absolutely necessary to make a good fuel, such as mineral tar, coal tar, gas tar, mineral pitch, vegetable pitch, resin, asphaltum, or any other bituminous matter, chalk, or lime, saw dust, anthracite or stone coal, coke or coke dust, and breeze. And in order to give the best information in my power for carrying out my invention, I will describe a process of combining and forming these materials into several species of fuel.

Description of the process employed.—Take 30 lbs. of vegetable tar, coal tar, gas tar, mineral pitch, vegetable pitch, resin, asphaltum, or any other bituminous matter, (Note—the vegetable tar, coal tar, and gas tar, will readily mix with the other ingredients used, but if either mineral pitch, vegetable pitch, resin, asphaltum, or any other bituminous matter be employed, it should first be dissolved in boiling water, and whilst hot, mixed with the other materials,) 18 lbs. of dry mud, (the best for the purpose is that taken from rivers,) clay, marl, or any other earth containing vegetable matter, and 50 gallons of water, and mix them together; then add, by degrees, 30 lbs. of powdered lime (stone lime is the best) or chalk passed through a fine sieve, and 1 ton of small or dust of bituminous coal. The whole should then be well stirred up with rakes or other suitable instruments, until the several materials are thoroughly combined, or they may be mixed together by machinery; it being necessary to obtain a perfect blending of the materials, in order to their adhering together and burning equally. The materials so combined are then to be put into moulds of any shape, (though it were better that they should be either square, oblong, or angular,) the dimensions of which may be of any size found most convenient, and then pressed, either in a screw, lever, or other press; but I claim the combination as an invention, whether the same be submitted to pressure or not, the object and advantage of pressing being the holding of the materials together, to increase the period and duration of combustion, and reduce the bulk as much as practicable. The lumps or blocks thus produced are to be placed to dry, leaving spaces between the lumps for the circulation of the air, and it will facilitate the drying to place them in a room or shed, the atmosphere of which can be heated; though in warm, dry weather this will not be necessary.

I have also to describe another species of fuel which forms a desirable fuel for use in furnaces having a powerful draught Take 10 cwt. of small oven made coke or coke dust, (which proportions will admit of variation,) 30 lbs. of tar, or any other of the bituminous matters before specified, 200 lbs. of dry mud, clay, marl, or other earth containing vegetable matter, 50 gallons of water and 30 lbs. of lime or chalk, and mix, mould, and press them in precisely the same manner as described for manufacturing the first mentioned fuel.

I have also to describe a third species of fuel. Take 15 cwt. of small or dust of butuminous coal, 5 cwt. of breeze, (which proportions will also admit of variation,) 30 lbs. of tar or any other of the bituminous matters before specified, 200 lbs. of dry clay, marl, mud, or other earth containing vegetable matter, 50 gallons of water, and 30 lbs. of lime or chalk, mixed, moulded, and pressed in like manner.

I have also to describe a fourth species of fuel. Take 13 cwt. of the anthracite or stone coal, 7 cwt. of small, or dust of bituminous coal, (which proportions will admit of considerable variation,) 40 gallons of water, 40 lbs. of tar or other bitumen as before, 30 lbs. of lime or chalk, and 180 lbs. of dry clay, mud, marl, or other earths containing vegetable matter, mixed, moulded, and pressed in like manner.

I have also to describe a fifth species of fuel. Take 15 cwt. of small, or dust of bituminous coal, 5 cwt. of sawdust, (which proportions will admit of considerable variation) 40 lbs. of tar or other bitumen as before, 200 lbs. of dry clay, mud, marl, or other earth, containing vegetable matter: 70 gallons of water, (the quantity of water must be varied in proportion as the quantity of saw dust is used,) 30 lbs. of lime or chalk, mixed, moulded and pressed in like manner.

I have also to dercribe a sixth species of fuel. Take 5 cwt. of peat turf, peat earth, peat moss, or bog earth; 5 cwt. of sawdust; 10 cwt. of small, or dust of bituminous coal; 30 lbs. of lime, or chalk; 30 lbs. of tar, or other bitumen as before; 200 lbs. of dry clay, mud, marl, or other earth containing vegetable matter, and 70 gallons of water, mixed, moulded and pressed in like manner.

I would observe, that in manufacturing each of the above species of fuel, the ingredients "lime" and "bitumen" may be omitted, but I find that the use of them not only increases the adhesion of the other materials, but the lime has the effect of neutralizing the sulphurous acid gas contained in the coal, and the bitumen adds to the ready combustion of the fuel. And further, that I prefer the use of vegetable tar to any other bitumen, of mud, (especially river mud, and more particularly such as is taken from the river Thames) to any other earth, of stone lime, to chalk or any other description of lime; and the sawdust from the pine to the sawdust of any other description of timber.

MECHANICAL SCIENCE.

The following rule for determining the size of journals for shafts appeared, we believe, originally in the Mechanics' Magazine a work under the editorial charge of D. K. Minor, Esq.

and at that time the medium of publication for the transactions of the Mechanics' Institute. We republish it from a belief in its great usefulness to the practical machinist.

STRENGTH OF THE JOURNALS OF SHAFTS.

Lateral Strength.

Mr. Roberson Buchanan, in his essay on the strength of shafts, uses the following rule, which is simple enough, and easy to be remembered: "the cube root of the weight in cwts. is nearly equal to the diameter of the journal." "*Nearly equal*"—being prudent to make the journal little more than less, and to make a due allowance for wearing.

Examples.—What is the diameter of the journal of a water wheel shaft, 13 feet long, the weight of the wheel being 15 tons?

$$\sqrt[3]{15\times 20}=6{\cdot}7 \text{ or } 7 \text{ inches.}$$

But the following rules are the most correct, and ought to be used on all occasions:

When the weight is in the middle.

1. Rule.—Multiply the weight in pounds by the length in feet; divide this product by 500, and the cube root of the quotient will be the diameter in inches.

When the weight is between the middle and end.

2. Rule.—Multiply the short end by the long end; then multiply that product by four times the weight in lbs. Divide this product by 500 times the length in feet, and the cube root of the quotient will be the diameter in inches.

When the load is uniformly distributed over the length.

3. Rule.—Multiply the length in feet by the weight in pounds, and one tenth of the cube root of the product will be the diameter in inches.

When fixed at one end, and the load applied at the other.

4. Rule.—Multiply the length of projections in feet by the weight in lbs. and the fifth part of the cube root of this product will be the diameter in inches. [This last does not directly apply to shafts—but it may be useful for other purposes.]

EXAMPLES.

By Rule 1:

$$\frac{33600\times 13}{500}=873 \qquad \sqrt[3]{873}=9\tfrac{1}{2} \text{ in. dia.}$$

By rule 3:

$$33600\times 13=436800 \qquad \frac{\sqrt[3]{436800}}{10}=7{\cdot}65 \text{ in.}$$

To resist tension or twisting.

It is obvious that the strength of a revolving shaft is directly as the cubes of its diameter and revolutions; and inversely as the resistance it has to overcome.

Mr. Buchanan, in his essay on the strength of shafts, gives the following data, deduced from several experiments, viz: That the fly wheel

shaft of a 50 horse power engine, at 50 revolutions per minute, requires to be $7\frac{1}{2}$ inches diameter; and therefore the cube of this diameter, which is $= 421{\cdot}875$, serves as a multiplier to all other shafts in the same proportion; and taking this as a standard, it gives the following multipliers, viz:

For the shaft of a steam engine, water wheel, or any shaft connected with a first power, - - - - - - - - - 400

For shafts in insides of mills, to drive smaller machinery, or connected with the shafts above, - - - - - - - - 200

For the small shafts of a mill or machinery, - - - - - 100

From the foregoing, the following rule is derived, viz:

The number of horses' power a shaft is equal to, is directly as the cube of the diameter and number of revolutions; and inversely, as the above multipliers.

Note.—Shafts here are understood as the journals of shafts—the bodies of shafts being generally made square.

Example 1.—When the fly wheel shaft of a 45 horse power steam engine makes 90 revolutions per minute, what is the diameter of the journal?

$$\frac{45\times400}{90}=200 \quad \sqrt[3]{200}=5{\cdot}8 \text{ in. dia.}$$

Example 2.—The velocity of a shaft is 80 revolutions per minute, and its diameter is three inches. What is its power?

$$\frac{3^3\times80}{400}=5{\cdot}4 \text{ horse power.}$$

Example 3.—What will be the diameter of the shaft in the first example, when used as a shaft of the second multiplier?

$$\frac{5{\cdot}8}{1.25}=4{\cdot}64, \text{ or } \sqrt[3]{\frac{45\times200}{90}}=4{\cdot}6 \text{ in. dia.}$$

[The diameters of the second movers will be found by dividing the numbers in the table by 1·25, and the diameters of the third movers by dividing the numbers by 1·56.]

The more abstruse rules of arithmetic are seldom remembered after our school days with sufficient clearness to render their application easy; we therefore insert the following simple and concise rule for the extraction of the cube root, furnished by a friend who has had much experience in teaching these matters.

Rule.—Point off every *third* figure, beginning with the units; find the greatest cube number contained in the first left hand period, and place the cube root of it in the quotient. Subtract its *cube* from the first period and bring down the next three figures; divide the number thus brought down by 300 times the square of the first figure of the root, and it will give the second figure; add 300 times the square of the first figure, 30 times the product of the first and second figures and the square of the second figure, together, for a divisor; then multiply this divisor by the second figure and subtract the result from the dividend; and then bring down the next period, and so proceed till

all the periods are brought down. EXAMPLE.—Required the cube root of 48228544.

	48228544 (364	
	27	
3276)	21228	
	19656	
393136)	1572544	
	1572544	

Divide by	$300\times3\times3=2700$
	$30\times3\times6=540$
	$6\times6=36$
First Divisor,	3276
Divide by	$300\times36\times36=388800$
	$30\times36\times4=4320$
	$4\times4\times4=16$
Second Divisor,	393136

The following is a table of the diameters of shafts, being the first movers, or having 400 for their multipliers, upon the foregoing principles.

TABLE.

Diameters of the Journals of First Movers.

	REVOLUTIONS.									
Horse Power.	10	15	20	25	30	35	40	45	50	55
4	5.5	4.8	4.5	4.	3.7	3.8	3.5	3.3	3.2	3.1
5	5.9	5.1	4.7	4.4	4.1	3.9	3.7	3.6	3.5	3.3
6	6.3	5.5	5.	4.6	4.4	4.1	4.	3.8	3.7	3.6
7	6.6	5.8	5.2	4.9	4.6	4.4	4.2	4.	3.9	3.7
8	6.9	6.	5.5	5.1	4.8	4.6	4.4	4.2	4.1	4.
9	7.2	6.3	5.7	5.5	5.	4.8	4.5	4.4	4.2	4.1
10	7.4	6.6	5.9	5.6	5.2	4.9	4.7	4.6	4.4	4.2
12	7.9	6.9	6.3	5.8	5.6	5.4	5.2	5.	4.8	4.6
14	8.3	7.2	6.7	6.2	5.9	5.6	5.4	5.2	5.	4.7
16	8.7	7.6	7.1	6.6	6.1	5.8	5.6	5.4	5.2	5.
18	9.	7.9	7.5	7.	6.6	6.2	5 8	5.6	5.4	5.2
20	9.3	8.1	7.4	7.2	6.6	6.4	6.9	5.7	5.6	5.4
25	10.	8.5	8.	7.4	7.1	6.8	6.3	6.	5.9	5.6
30	10.7	9.3	8.4	7.9	7.4	7.1	6.9	6.7	6.5	6.3
35	11.4	9.8	8.9	8.4	7.9	7.4	7.1	6.9	6.6	6.5
40	11.7	10.5	9.3	8.8	8.3	7.8	7.4	7.2	6.9	6.7
45	12.	10.6	9.7	9.2	8.7	8.1	7.6	7.4	7.	6.8
50	12.6	11.	10.	9.3	9.	8.5	8.	7.8	7.4	7.3
55	13.4	11.4	10.4	9.8	9.1	8.8	8.4	8.	7.5	7.4
60	13.6	12.	10.8	10.	9.3	9.	8.6	8.2	7.7	7.6

INCHES DIAMETER.

On the mode of producing fac-simile copies of Medals, &c. by the Agency of Voltaic Electricity.

To the Editor of the London Journal and Repertory of Arts, &c.

SIR,—You request a condensed account of my voltaic process of working copper. I shall endeavor to give you one, premising, I shall divest it as much as possible of electro-chemical detail, that it may be rendered quite intelligible to those unacquainted with that science.

It has been long known that one metal will precipitate another from its solution. As one instance, if we take a solution of sulphate of copper, the blue vitriol of commerce, and dip the blade of a penknife in it, in a few seconds it becomes coated with pure metallic copper. We have here an instance of simple electro-chemical action, and I may say the type of all the experiments I have lately published on the subject. Subsequently, it has been found that copper itself possessed this quality, by acting on *its own* solutions, and to a much greater extent than in the first instance, but under a somewhat different condition.

If we take a clean copper wire and dip it into a solution of the sulphate of copper, on taking it out, we find no perceptible difference is made on its surface. If we now take the copper wire, or slip of that metal, and solder to one of its ends a piece of zinc, and bend the two metals so combined into the shape of the letter U, and again place the copper end in the cupreous solution, and the zinc end in a very weak solution of salt and water,—if allowed to remain some time, it will be found the copper end has received a thin coating of solid copper. In this instance, as in most others connected with continued galvanic arrangement, it is a *sine qua non*, that the two fluids must *not* be allowed to intermingle, yet must be in connection with each other.

To effect this, various expedients have been resorted to, with more or less success; but to give a simple illustration of how this may be effected, in order to attain the result mentioned above, take a piece of stout brown paper, and bend it into the form of a piece of tube about three inches long, and perhaps an inch in diameter. This may be conveniently done, by bending the paper round a phial to make it assume the desired form; let the edges of the paper overlap, and fasten them together with a bit of sealing wax. A paper tube is thus obtained, open at both ends, but one end must be closed; this may be done simply, by cutting a piece of card into the shape of the bottom end, but a little larger, and fastening it on with sealing wax, just as we would take an impression of a seal, by covering the disc of card with the wax, and while soft dip the end of the paper tube into it; when set, we shall thus obtain a vessel capable, to a certain extent, of containing a fluid, yet from its porous texture, this fluid would be in connection with any other fluid that might surround it on the other side.

Having obtained such a tube, we three parts fill it with salt and water, or better still, glauber salt and water, which is a sulphate of soda. We then take a common drinking tumbler, containing a quantity of sulphate of copper in solution, and take the paper tube containing the saline solution, and immerse it in the tumbler, taking care that both fluids shall attain the same level. If we now take the bent slip of copper and zinc, and place the copper end of it in the cupreous solution and the zinc end in the saline solution, contained in the paper tube, and let this remain at rest for a few hours (if in a warm situation so much the better) it will be found on removing the combined pieces of metal, that the copper end has obtained a solid covering of pure copper. I have here described an elementary voltaic battery,—and the most extensive one ever constructed, is only a combination of such simple arrangement connected together by copper wires.

In this arrangement the inside of the paper tube, containing the saline solution, is termed the positive cell,—the outside one—the tumbler

containing the cupreous solution—is termed the negative cell. The zinc end of the combined metals, is termed the positive electrode,—the copper end, the negative electrode. With a modification of this very simple apparatus, all the experiments of this process may be readily performed. I have judged the above explanation necessary, as many persons have imagined the apparatus when constructed, was in some way or other connected to a galvanic battery.

By performing the above experiment, we acquire a clear idea of voltaic arrangement, while the eye becomes acquainted with the phenomena produced.

Were I required to produce an exact fac-simile of a medal in copper, I should proceed as follows:—Suppose it were equal in size to half-a-crown,—I should procure a piece of glass tube, (a short gas glass of the largest diameter does best) and then take a piece of flat glass and oil its surface slightly,—this done, I place one end of the tube on the oiled glass, and pour into it some fluid plaster of paris, to the depth of ½ or ⅝ths of an inch; when this sets, the oiled glass will easily slip off, and a porous bottom will thus be given to the tube, which in all cases should be of equal or superior diameter to the medal required to be copied. This, and a common size drinking tumbler, comprehends nearly all the apparatus required.

I should now procure two pieces of pretty thick sheet lead, and with a plane, smooth one of the surfaces of each piece, in the manner wood is planed. I then take the medal to be copied, and place it between the bright surfaces of the pieces of lead, and place the whole under a press. Should the medal not be very large, a copying press will be found sufficient, but when larger, a more powerful one is requisite. In either case the object to be acted on must be under the centre of pressure.

When removed from the press a most exact mould of each side of the medal will thus be obtained. I now take a piece of copper wire, varying in length according to the size of the apparatus,—in the present instance, from 12 to 16 inches may be used. To one of its ends, I solder a piece of zinc, rounded, and sufficiently large to go into the gas glass. To the other end I solder* one of the leaden moulds. I have now what is termed a "galvanic pair," the leaden mould constituting the negative electrode, and the zinc the positive one.

The wire is now bent in such a form, that the lead and the zinc will be opposed to each other,—the opposed surfaces being distant about 1½ inches. To effect this, bend the wire into a right angle, at its junction with the lead, and place the lead in a horizontal position, at the bottom of the tumbler,—the impressed side being uppermost. The gas glass, with its plaster bottom, must now be placed exactly over the lead mould.† The wire must again be bent in the shape of the letter U, in order that the zinc end may go into the gas glass and *touch*, or nearly so, its plaster bottom. This like the lead, must lay horizontally, on the bottom

* The wire should be soldered to the blank side of the lead.

† In order that the gas glass may not *rest* on the plate to be deposited on, I suspend it by a wooden collar, which rests on the outside vessel, and keeps the bottom of the inside one, at a quarter of an inch distance from the plate.

of the interior cell. To conveniently effect this, the end of the wire should be soldered to the centre of the zinc disc.

These arrangements being neatly effected, I now pour a hot saturated solution of sulphate of copper into the tumbler, being in connection with the lead. A few undissolved crystals may be added with advantage. I next pour a hot solution of glauber salt into the gas glass, in connection with the zinc, taking care it does not exceed the level of the fluid in the outside cell. This latter solution must not be saturated, but only a few crystals of the salt put in the water. This may now be allowed to remain for a day or two, until the blue color of the cupreous solution is assuming a pale green; then add a few crystals of the salt of copper. Should a very thick deposition of copper be required, it is well to renew the solutions entirely, as the acid that is set free, materially interferes with the success of the process.

This process may be quickened in a very great degree, by the application of heat, and the metal so deposited, is of a much superior character to that deposited under a common temperature. The apparatus I have described, may be kept at a temperature of from 120 to 160°, by being placed at the side of a fire, and a deposition got in a very few hours.

When it is judged the requisite thickness is deposited, I proceed to to get the copper so deposited, off the mould, as follows: previous to immersing the lead into the solution, I generally varnish the back and edges of the mould, to prevent deposition on any other portion of its surface than that opposed to the zinc.

On removing it from the apparatus, I file the edges of the copper until they are flush or parallel with the lead. I then heat the copper side by holding it over the fire, and suddenly plunge it in cold water. On examination it will be found some portion is loosened from the lead when, by inserting the edge of a knife, the plate of copper will come readily off, bearing a *most exact* impress of the original.

I have thus far described how to proceed, in the progress of taking a single medal; but it will at once be perceived, that the same instructions apply to a sheet containing an indefinite number, by only enlarging the apparatus. By exactly the same process here described, I have succeeded in obtaining exact copies of engraved wood blocks and copper plates. I have also succeeded in stereotyping in copper, some elaborate ornamental printing, equal in area to a large octavo page.

I have used lead for most of my latter experiments, instead of copper, as that metal precipitates copper, when in connection with zinc, and it is much easier got off the mould, in consequence of the different degrees of expansibility possessed by the two metals, on the application of heat. The time occupied by the whole process, is also materially abridged. I have not yet had an opportunity of trying the "fusible metal," that melts at a temperature of 212° Fahr. It must also be borne in mind, that as far as our knowledge extends, it is an electrochemical law, that a *metallic* surface must be present, before we are able to precipitate a metal from its solution. THOMAS SPENCER.

☞This process has been much simplified by Franklin Peale, Esq. first coiner of the mint at Philadelphia, a full account of which will be given in our next number. A large medal executed by Mr. Peale, may be seen at the library of the Mechanics' Institute in this city. ED.

MISCELLANEOUS.

M. Pape's Patent Table Piano Fortes.—Amongst the objects of the fine arts admitted at the late exhibition of the produce of French industry, pianos were, unquestionably, the most remarkable. Sixty-seven masters sent to the exhibition nearly two hundred pianos, amongst which were several of an entirely new shape; such as table, gueridon, oval, hexagon, and consol. These new instruments are made at the manufactory of M. Pape, piano-maker to the king, who also exhibited a square piano, which judges have justly considered as a master-piece of its kind. The latter is veneered with sheets of ivory, part of which is carved and inlaid, and forms a most beautiful mosaic design. M. Pape obtains these ivory sheets by means of spiral machinery of his own invention, which produces from elephant's teeth of an ordinary size, sheets of from twelve to fifteen feet in length, and two feet in width. This invention will, no doubt, be appreciated by miniature painters, to whom this mechanical discovery will be of very great advantage. M. Pape also exhibited an horizontal, grand piano, of a small size. The most remarkable improvement in this instrument is the sounding-board, which is so disposed that the tension of the string stretches, and keeps the sounding-board level. The consequence is, that the sound improves in course of time, whilst in pianos of the ordinary construction, the contrary will happen. M. Pape's new instruments have attracted the attention of the royal family, and her Royal Highness the Duchess of Orleans has purchased one of the table pianos for her own use.

Inventor's Advocate.

The plan here spoken of, for producing large sheets of ivory by sawing around the tooth, has been practised for some time in this city.

Alpaca Wool.—At a late meeting of the British Association, Section D, (Zoology and Botany) on the Saturday, some remarks were made on the introduction of a species of Auchenia into Britain, for the purpose of obtaining wool, by Mr. W. Danson. Samples and manufactured specimens of Alpaca wool, in imitation of silk, and without dye, as black as jet, were exhibited; and Mr. Danson stated, that the animals producing it ought to be propagated in England, Ireland, Scotland and Wales; and to the two latter places the Alpaca is well suited, being an inhabitant of the Cordilleras, or mountainous district in Peru. Importations have already have already taken place to the extent of 1,000,000 pounds, and are likely to increase. There are five species of Llamas: of which the Alpaca has fine wool, six to twelve inches long, as shown by the specimens exhibited; the Llama, the hair of which is very coarse; and the Vicuna, which has a very short, fine wool, more of the beaver cast. The Earl of Derby has propagated the Alpaca in his private menagerie, at Knowsley; and Mr. Danson understood that Mr. Stephenson, at Oban, in Scotland, has a few of these animals Their wool would not enter into competition with the wool of the sheep, but rather with silk. It is capable of the finest manufacture, and is specially

suited to the fine shawl trade of Paisley, Glasgow, &c. The yarns spun from it are already sent to France in large quantities, at from 6s. to 12s. 6d. per pound, the price of the raw Alpaca wool being now 2s. and 2s. 6d. per pound. Mr. Vigors stated, that one of the objects of the Zoological Society of London, was to introduce animals which might be made available for draught, food, or clothing. Amongst others, this animal had been kept in the Society's gardens. They bred and looked well, but were subject to disease, which was the case with most foreign animals at first. Animals were generally found adapted to the districts in which they lived, as the camel, &c.; but animals which afforded food and clothing, are usually capable of universal dispersion, as the horse, sheep, &c. He believed that in the course of time the Llamas referred to would be acclimated amongst us. Athenæum.

The Art of Illuminating revived.—M. Galot, we believe, of Brussels, has succeeded in accomplishing the illumination of MSS. with all the brilliancy which characterizes the works of the middle ages. Most of the paintings of the old MSS. are relieved with gold: the figures, too, and minor parts, are frequently brought out from a flat ground of gold, sometimes from a rich bed, in imitation of tapestry; but from the introduction of too much gum, the richest illuminations chipped and cracked in the bending of the page. M. Galot contrives to *remedy this difficulty;* and by his new process, succeeds in producing illuminated MSS. equal in beauty to those of the middle ages. We are not so much gratified with the revival of this art, as an art, as with the consolation which it affords the scholar, that the works which are daily going to decay, though almost imperceptibly, may thus be snatched from ruin by a timely *interference.* Belgium is rich in these choice objects. The missal of St. Louis, (IX) and of Anne of Brittany, are in the Royal Library; the "Livre d'Heures" of Catharine de Medicis is in the possession of the Baron Van Hoorn, of Holland. The Royal Library also contains a great number of very choice poems and romances of the 12th, 13th, and 14th centuries. Inventor's Advocate.

Antique Artillery.—Some curious relics of ancient English artillery and ammunition have recently been discovered upon the western shore of the Isle of Walney, Lancashire, buried in the sand and clay, at a place only accessible at low water. They consist of a gun ten feet in length, the breech in the centre, so as to fire both ways, with two rings near the muzzle, to sling it by. This piece is formed of thick plates of iron, hooped. Other guns, and stone balls of different sizes; a pair of bronze compasses of curious construction, some old swords, a buckle, and a number of other articles.

Whitelaw's Water-Mill.—This new mode of applying the power of water, is an invention which will in all probability supersede most of the water-wheels now in use, and is applicable where water-wheels cannot now be adopted, as in high and small streams, or in very low falls. The engine recently erected at Mr. Sterrat's works, near Paisley, to the present time continues to work most admirably—nine-tenths of the weight of the water being obtained as effective power. It is also

as completely under control as a steam-engine, and has likewise a self-acting governor. One of the most striking proofs that the whole of the power of the water is exhausted before it issues from the arms of the mill, is, that although they are revolving at a speed of 180 revolutions a minute, the water drops quietly from their mouths on the floor of the mill, in which there is not the slightest current. Inventor's Advocate.

Salt Water.—Mr. Miller, employed in the inspection of the Greek manuscripts of the Royal Library of Paris, has stated, in a communication to the Academy, that the ancients were acquainted with various methods of making salt-water fresh; that they make mention, among other ways, of distillation, and of receiving the evaporation on sponges, the water expressed from which is perfectly sweet.

Important Discovery.—Professor Graham, at the meeting of the British Association, made an important practical suggestion, which may be the means of saving many lives. He observed that the after-damp, or carbonic acid, left in the atmosphere of a mine after an explosion, is supposed to occasion in many instances a greater loss of life than the explosion; at the same time it renders assistance impracticable. In many cases the oxygen of the air is not exhausted by the explosion, although, from the presence of five or ten per cent of carbonic acid, it is rendered irrespirable. The atmosphere will be rendered respirable, by withdrawing carbonic acid, and he suggested a method by which this might be effected. He found that a mixture of slaked lime and pounded Glauber's salts in equal proportions, has a singular avidity for carbonic acid, and that air might be completely purified from that deleterious gas, by inhaling it through a cushion of not more than an inch in thickness, filled with that mixture, which could be done without difficulty. This lime-filter would be an additional source of security wherever the safety-lamp is necessary, and it should be invariably employed by persons who descend into a mine to afford assistance to the sufferers.

Modes of Measuring Height of Mountains.—We hear that Captain Washington, the Secretary of the Geographical Society, has been occupied in Cumberland during the recess, in trying the comparative accuracy of different methods of measuring the heights of mountains, as Helvellyn, (3055 feet) &c.—1. By Sir John Robison's glass tubes, for bringing a portion of air from the summits, as described at the meeting of the British Association, at Newcastle, (*Athen.* No. 567.)—2. By the temperature of boiling water, as ascertained by a common thermometer. 3. By Newman's mountain barometer, as compared with the heights measured trigonometrically in the course of the ordnance survey.
Athenæum.

Effects of Lightning on Ships.—At the late meeting of the British Association at Birmingham, Mr. Snow Harris stated, that he had lately been collecting instances of damage by lightning in the British navy, and had deduced some results not unworthy of notice. It appeared, in 100 cases of ships struck by lightning, that the number struck on the main-mast were to those struck on the fore-mast as 2 : 1; to those struck

on the mizen-mast, as 10 : 1; to those struck on the bowsprit, as 50 : 1. About 1 ship in 6 is set on fire in some part of the hull, sails, or rigging. In one-half the cases, some of the crew were either killed or wounded. In the 100 cases alluded to, 62 were killed, and about 114 wounded. These were exclusive of one case of a frigate, in which nearly all the crew perished, and of 12 cases in which the numbers killed or wounded were set down in the accounts given, as several or many. In these 100 cases, there were damaged or destroyed 93 lower masts, principally line-of-battle ships and frigates; 83 top-masts, 60 top-gallant masts. Professor Stevelly stated, that he had been almost an eye-witness to a case very similar to those Mr. Harris had brought under notice. When he was delivering a lecture on astronomy at the Royal Institution in Cork, in 1829, a thunder-storm came on, and a ship's mast, within a few hundred yards of the room in which he was sitting, was struck, and the entire mast to within about five feet of the deck, shivered into small fragments, about eight or ten inches long, and as thick as a person's finger. What saved the lower part of the mast was, that the iron pump-handle came near it at the place the ravage ceased. The lightning glanced off along it to the pump iron, and so into the water. Professor Forbes observed, that a collection of facts, such as Mr. Harris had begun, was of more importance to a maritime state like ours, than most persons were aware of. He conceived that experiments might, with much benefit be undertaken, to establish the fact, whether chains or straps of metal would afford the best protection to ships, and in what manner they should be put on, so as to afford the greater security. He was convinced accidents were constantly occurring at sea from this cause, which no person ever heard of: the entire crew, perhaps, perishing between the two awful elements to which they became exposed, after the ship had been set on fire. The case of the New-York packet, which had been struck and set on fire by lightning, was a recent example of the importance of the investigation he was advocating. He had seen the compasses of that vessel after she had been struck; most of them had their poles completely reversed; so that, in this case, the danger to which the ship and passengers were subjected was of a very mixed nature. In confirmation of what had been said by Professors Stevelly and Forbes, Mr. Harris mentioned two instances in which masses of wood struck by lightning, without apparent damage externally, but which, nevertheless, had been set on fire within the substance, and had burst into a flame a long time after the accident. This happened on board a Neapolitan line-of-battle ship, in the Mediterranean. The ship had returned from sea, and anchored, after having been recently struck by lightning; all of a sudden, the mast burst out into a flame. The author considers that many of the Liverpool and American traders, which have been within a few years either wholly or partially destroyed by fire, after being struck by lightning, have suffered from the electric agency having produced a similar result on the substance of the cargo. He thought the consequences of the action of electricity might, with very little trouble, be effectually prevented. Athenæum.

Lightning Conductors.—One of the most important inventions for the preservation of human life and property, is the application of the

lightning conductors to ships of war and merchant vessels. The old mode of conducting this formidable fluid from the mast-head to the water, and which is still used in many ships, is by copper chains made fast aloft, and descending to the water's edge: these are kept in boxes amongst the stores, until the appearance of the weather indicates that lightning may be soon expected: the men are then sent up to place these chains, if there be time for it; but often, before they can be got ready, the danger has arrived or is past. The conductor we now describe is of a superficial kind. It consists of two *laminæ* of sheet-copper, laid one on the other, in lengths of about four feet: they are placed so that the closed joints of one fall on the continuous portions of the other; their width is from an inch and a half to six inches, according to the size of the mast to be furnished with them, and are together three-sixteenths of an inch in thickness: they are riveted together at the points of junction, to form an elastic and continued line: this is then inlaid at the after-part of the mast, and secured by copper nails. The conducting line of metal in the hull is made perfect and secured upon the keelson. The conductor, thus constructed, will pass from the vane-spindle to the keel, in one unbroken line; and no damage can take place, as there is no interruption to the passage of this tremendous power along the metallic line. These properties of Mr. Snow Harris's conductor were fully tested at the Polytechnic Institution in London, recently, by Mr. Backoffer, the lecturer on experimental philosophy. A square-rigged vessel, afloat in the canal, was fitted with this apparatus, and the powerful electric discharge was communicated to the extreme point of the main-top gallant-mast. It passed along the conductor, and out of the vessel, without injuring any thing, but continuing its course several yards, it exploded some gunpowder in a boat, placed on purpose to prove the actual presence and power of the electric fluid.

Cultivation of the Sunflower.—On inquiring into the use made of this plant, we were given to understand that it is here (in Tartary) raised chiefly for the oil expressed from it. But it is also of use for many other purposes. In the market places of the larger towns we often found the people eating the seeds, which, when boiled in water, taste not unlike the boiled Indian corn eaten by the Turks. In some districts of Russia, the seeds are employed with great success in fattening poultry: they are also said to increase the number of eggs more than any other kind of grain. Pheasants and partridges eat them with great avidity, and find the same effects from them as other birds. The dried leaves are given to cattle in place of straw, and the withered stalks are said to produce a considerable quantity of alkali.

Bremner's Excursions in the Interior of Russia.

Gas produced by a New Process.—An experiment in gas-lighting, by the Comte de Val Marino, was made on Thursday evening, on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen, who were invited to witness the result. A small gasometer was erected for the purpose, which was connected by tubes with a furnace built of brick, and containing three retorts, one of which was supplied with water from a syphon; another was filled with tar; and both being decomposed in the third retort, formed the sole materials

by which the gas was produced. The process appeared to be extremely simple, and the novelty of the experiment consisted in the fact, that the principal agent employed to produce the gas, was common water combined with tar; but, according to the theory of the inventor of this new species of gas, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The purity and intenseness of the flame was tested in a very satisfactory manner, and those who witnessed the experiment appeared perfectly satisfied with the result. The great advantage of this sort of gas over that produced from coal consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought, without the necessity of its undergoing the tedious and expensive process of condensation and purification; for in this instance, as soon as the preliminaries were completed, the light was produced in a perfect state within a few feet of the gasometer, which, although of inferior size, was said to be capable of affording light for ten hours to at least five hundred lamps or burners. With regard to the comparative expense, it was also stated that one thousand cubic feet of gas manufactured by this process, could be supplied to the public for about one-third the price now charged by the coal-gas companies; and it was said to be equally availing for domestic use, and more safe than the common gas, inasmuch as small gasometers might at a trifling expense be fixed at the back of grates in private dwellings, from which the gas could be conveyed in India-rubber bags to any part of the house, thereby preventing the many accidents which occur by the use of tubes and pipes. The Comte de Val Marino, who has conquered the difficulty hitherto experiened in bringing this species of gas into use, superintended the arrangements, and evinced a natural anxiety to bring his experiment to a successful issue. He has taken out a patent for his discovery, and he has improved upon the burners now in use, so as to render the light produced more pure and intense. For this improvement he is also secured by a patent. How far gas of this description can be brought into general use, or whether in point of economy the public would be benefited by its adoption, are questions which we have not the means of deciding; and, without hazarding any opinion on the subject, we can only say, that the experiment, as far as it was tried in this instance, appeared to be quite successful.

Structure of the Earth's Surface.—Had the earth's surface presented only one unvaried mass of granite or lava, or had its nucleus been covered by entire concentric coverings of stratified rocks, like the coats of an onion, a single stratum only would be accessible to its inhabitants; and the varied intermixtures of limestone, clay, and sandstone, which, under the actual disposition, are so advantageous to the fertility, beauty and habitability of the globe, would have had no place. Again: the inestimably precious treasures of mineral, salt and coal, and of metallic ores, confined as these are to the older series of formations, would,

under the supposed more simple arrangement of the strata, have been wholly inaccessible; and we should have been destitute of all these essential elements of industry and civilization. Under the existing disposition, all the various combinations of strata, with their valuable contents, whether produced by the agency of subterraneous fire, or by mechanical or chemical disposition beneath the water, have been raised above the sea, to form the mountains and plains of our present earth, and have still further been laid open to our reach by the exposure of each stratum along the sides of valleys. * * * The total quantity of all metals existing near the surface of the earth (excepting iron) being comparatively small, and their value to mankind being of the highest order, as the main instruments by the aid of which he emerges from the savage state, it was of the utmost importance that they should be disposed in a manner that would render them accessible by his industry; and this object is admirably attained through the machinery of metallic veins. Had large quantities of metals existed throughout rocks of all formations, they might have been noxious to vegetation; had small quantities been disseminated through the body of the strata, they would never have repaid the cost of separation from the matrix. These inconveniences are obviated by the actual arrangement under which these rare substances are occasionally collected together in the natural magazines afforded by metallic veins. Dr. Buckland.

Cast Iron, Steel, &c.—In a paper read at the late meeting of the British Association, at Birmingham, "On the relative combinations of the constituents of cast-iron, steel, and malleable iron," by Dr. Charles Schafhaeutl, of Munich, the author stated that pure iron could not be welded; that the welding power of iron depended on its alloy with the carburet of silicon, and also that the good and various qualities of all the wrought irons depended on the alloys of pure iron with other metallic bodies; and that the presence of most of the electro-negative metals had been generally overlooked in the existing analyses of iron. The The presence of arsenic in Swedish steel, when forged red-hot, could be ascertained by its smell, as well as in the Low Moor iron. The usual solution of iron under analysis, in order to separate those metals from the iron, must be, for the necessary correction, divided into two parts: one to be treated with a current of sulphuretted hydrogen; the the other part *dropped* into sulphydrate of ammonia, and carefully digested. A small quantity of silica was more difficult to separate from a large quantity of iron, than generally seemed to be believed; and the real amount of carbon could *only* be ascertained by Berzelius's method of burning iron in a current of oxygen, or mixed with chlorate of potash and chromate of lead, in a glass tube, used first by Berzelius for analysis of organic bodies. The author maintained that steel was an entirely mechanical production of the forge-hammer, which tore the molecules of certain species of white cast-iron out of their original position, into which the forces of attraction, in respect to the centres as well as to the position of the molecules, had arranged those molecules by the slow action of heat. Steel, as it came out of the converting furnace or the crucible, was nothing more or less than white cast-iron, of which Indian steel, called wootz, was the fairest specimen. The author finally gave

an analysis of two specimens of cast-iron, and one of steel. The first specimen was French gray iron, from Vienne, department de l'Isere, obtained from a mixture of pea-iron ore with red hematite, by means of coal from Rive de Gier and heated air; specific gravity 6.898. The second iron was Welsh iron, from the tin-plate manufactory of the Maesteg iron works, near Neath, in South Wales, obtained from a mixture of clay iron-stone and Cumberland red ore, by means of coke and heated air. It was silvery white, without signs of crystalization; specific gravity 7.467. The third specimen was the fragment of a razor forged in the author's presence, in the work-shop of Mr. Rodgers, of Sheffield, of the specific gravity of 7.92. Several gentlemen, among whom were some connected with the iron trade, expressed a high sense of the value of this communication, from which it appeared that the peculiarities of Swedish iron, in a great degree, depended on the presence of arsenic, and those of Russia iron on the presence of phosphorus. Athenæum.

Railway Carriages.—F. C. Worsley, Esq. has just taken out a patent for various improvements in locomotive engines and carriages. The engine has the advantage of working from a fixed point, without being interfered with by the action of the springs, as in the present arrangement. It also admits a multiplier of velocity to any extent. The great effect produced, by the application of the power to a given point, in advance of the centre of the driving wheel, is, by its pressing always in a line perpendicular to the rail, (in other words, applying the power of the engine to raise the weight of the carriage, and place it on this given point in advance of the centre of the driving-wheel,) and causing the carriage to roll forward, independent of the bite on the rail. This principle is familiarly illustrated by the coachman, who, when he wishes to get his carriage out of the coach-house, places his weight on the front of the spoke of the hind-wheel, thereby causing it to roll forward. This effect we have seen beautifully illustrated by the working model; which, with this principle applied, will, with smooth wheels, run up an inclined plane of one in four; whereas, in applying the power to the same model in any other way, the wheels grind round, and the carriage remains stationary: indeed, it may be fairly said that the present carriages grind, whilst the improvement of Mr. Worsley would roll the road. Inventor's Advocate.

Chemical Powers of Light.—M. Edmond Becquerel has recently communicated to the Académie des Sciences, some important investigations on the chemical powers of solar light, which will probably lead to new and valuable results. It has been long known that light has the power of variously affecting certain chemical compounds; sometimes causing combination between two elements, and in other cases effecting the decomposition of compound substances; and it has been found that when a pencil of light is decomposed by passing through a prism of glass, those rays which possess this power are differently refracted from the colored rays, and hence the existence of peculiar rays, to which the name of chemical rays is given, has been deduced. The chief difficulty in experiments on these rays, has been the slow nature of the actions

caused, and the difficulty of appreciating them. M. Becquerel has overcome these sources of uncertainty, and is enabled to study the chemical powers of light with ease, and measure the effects produced with considerable accuracy. The manner in which this is done is very simple. Two liquids, of different densities, but both conductors of electricity, and of such nature as to act chemically upon each other when exposed to the influence of solar light, are selected; and a portion of both is put into a cylindrical vessel blackened on the exterior. A plate of platinum is placed in the denser of the two fluids, and another similar plate is also immersed in the lighter liquid: these plates being then connected by means of platinum wires with the two terminations of a very delicate galvanometer, the apparatus is complete. If when thus arranged, a ray of light is suffered to pass through the mass of fluid, it causes chemical action to take place at the surface of contact between the two liquids, and a current of electricity which this sets in circulation is immediately rendered evident by the galvanometer. As the angle of deflection of the galvanometer indicates the power of the electric current, and as that is in exact proportion to the chemical action which originates it, it is evident that this arrangement gives an accurate measure of the power of the chemical rays of light, at different times, from different sources, and under various circumstances. M. Becquerel details some experiments on the quantity of these chemical rays which is intercepted when a ray of light is made to pass through screens of different substances, such as rock-crystal, mica, and variously colored glasses; and states that he is still engaged in experimenting on the subject.

Intellectual Resources of London.—There are in the metropolis no less than forty-one societies devoted to scientific, literary and collateral pursuits, meeting periodically during the session, which, with the great majority, commences in November, and terminates in June; and these distinct from the literary and scientific institutions, of which there is one in every considerable district. The Royal Society, the parent of the whole, founded in 1663, extends to every department of natural knowledge; but so numerous are the ramifications which have sprung from it, that its attention is now restricted to the more abstract departments of each. For the study of antiquities there are two: the Society of Antiquaries, founded in 1717, for the study of the antiquities of this kingdom; and the Numismatic Society, a flourishing association, which, as its name imports, is confined to coins and medals. For natural history there are eight: the Linnæan Society, alike for the objects of botanical and zoological investigation; in zoology two—the Zoological and Entomological Societies; and for horticulture and botany five, viz. the Horticultural, Royal Botanic, Metropolitan, and Botanical Societies, and the Royal Society of Horticulture, four of which hold periodic public exhibitions. For astronomy there are two, viz. the Royal Astronomical and the Uranian Societies. And for objects of particular or specific investigation, there are the Mathematical, Meteorological, and Electrical Societies. The Society of Arts, which stands alone prominent for the encouragement of the useful arts, was founded in 1754; and objects formerly embraced specially by it, are now comprehended in the more

exclusive exertions of the institutes of British Architects and Civil Engineers, and the Architectural Society. The Geographical and the Geological Societies are, as their names import, addressed to the study of the external characteristics and the structure of the earth. One body only, the Royal Society of Literature, is exclusively devoted to objects of literary research; the Royal Asiatic Society takes the wide and extensive range of the science, language and literature of the eastern continent; and the Statistical Society, dealing with facts, embraces the details of all sciences where numbers are concerned. The number of members in the last session is estimated at about 17,000; but the names of many of these are enrolled in more societies than one. The total amount of the incomes or the sums raised last year for scientific objects, was nearly £41,000; and the funded properties possessed by these societies, estimated last June, was £81,000. Only four, viz. the Royal, Antiquarian, Geological, and Astronomical Societies, receive aid from Government in public accommodation; and one other only, the Geographical Society, is assisted by grants from the same source, in the furtherance of its objects. There are twelve Mechanic Literary and Scientific Institutions, in the immediate circle of the metropolis, which average 4500 members, and an income of £7500. Unaided, therefore, by Government, the total annual amount raised for the diffusion of literary and scientific knowledge in the metropolis is about £50,000.

Art of Floating.—Any human being who will have the presence of mind to clasp the hands behind the back, and turn the face towards the zenith, may float at ease, and in perfect safety, in tolerably still water—aye, and sleep there, no matter how long. If not knowing how to swim, you would escape drowning when you find yourself in deep water, you have only to consider yourself an empty pitcher: let your mouth and nose, not the top part of your heavy head, be the highest part of you, and you are safe; but thrust up one of your bony hands, and down you go: turning up the handle, tips over the pitcher. Having had the happiness to prevent one or two drownings, by this simple instruction, we publish it for the benefit of all who either love aquatic sports or dread them. Walker.

Invention of the Thermometer.—The invention of the thermometer is generally attributed to Sanctario, an Italian physician of the 17th century. The instrument invented by him, however, is filled with air, and is therefore called an air thermometer; but that in more general use is filled with mercury, and is therefore called the mercurial thermometer. There are two objections to the instrument of Sanctario:—1. The dilatation is so great, that the length of the tube required where the change of temperature is considerable, renders the instrument inconvenient.—2. It is affected by the pressure of the atmosphere, which often varies without a corresponding variation in the temperature. Fahrenheit, of Amsterdam, was the first to modify and improve the instrument of Sanctario: he indeed claims the invention and introduction of the kind of thermometer now in general use. He substituted mercury for air in filling the instrument, which enabled him to use a much smaller one with the same degree of accuracy; but it was still very

defective, inasmuch as no two instruments formed in this way would agree in their results, because there were no fixed points to guide the maker in graduating the scales. Sir Isaac Newton first suggested the plan now in use to obtain the fixed points, founded on the fact that ice or snow melts, and water under similar circumstances boiled at an uniform temperature: consequently these two were made the fixed points from which to graduate the scales of the thermometers. In Fahrenheit's scale, the space between freezing and boiling water is divided into 180 equal parts. Water freezes at 32°, and boils at 212°. The zero, or commencement of the scale, was the result of accident. During the course of Fahrenheit's experiments on the thermometer, he made a visit to Iceland; and while there, fixed upon the temperature he then experienced as the greatest cold that would probably be produced by artificial means, and consequently a suitable point for the zero of the thermometer: this was afterwards ascertained to be the same temperature produced by mixing snow and common salt. Dr. Hope's Practical Chemist's Guide.

The Wonders of Horticulture.—Innumerable are the advantages which mankind have derived from the horticulturists. Few would suppose that the peach (from which branched the nectarine) had its origin in the almond; or that the shaddock, the citron, the orange, and the lemon, proceeded from the diminutive wild lime. That favorite edible, celery, springs from a rank and acid root denominated smallage, which grows on all sides of ditches, in the neighborhood of the sea. The hazel-nut was the ancestor of the filbert and the cub-nut; while the luscious plum can claim no higher source than the sloe. From the sour crab issues the golden pippin; and the pear and cherry originally grew in the forest. The garden asparagus, which grows, though not very commonly, in stony and gravelly situations near the sea, when growing spontaneously, is a diminutive plant; and none, indeed, but a practised eye, examining into the species which is reared by artificial culture, can discern the least resemblance. Wondrous to relate, the cauliflower, of which the brocoli is a sub-variety, is derived, together with the cabbage, from the colewort; a plant, in its natural state, with scanty leaves, not weighing half an ounce. The Crambe Maritima, which is found wild adjacent to the sea, has been improved into sea-kale; the invaluable potato is the offspring of a bitter American root of spontaneous growth; and the all-tempting pine-apple descends from a fruit which "in foreign climates grows wild by the sides of rivulets, and under the shade of lofty trees." Liverpool Standard.

Peculiar Characteristics of Australia—Australia seems to be more unlike the portions of the earth lately known to us, than any part of America, or any of the islands scattered through the Pacific and Indian seas. No volcanoes have yet been discovered, and no proof of the great antiquity of the products on its surface. Nearly all the species of plants, from the grasses to the loftiest ornaments of the forest, are new to the inhabitants of the old world. The indigenous animals are, in several instances, of a different character to any in the countries of the other quarters of the globe, while none but the dogs have any affinity to the animals of this new continent: and it is curious that its rivers and

marshes are not known to contain any of the lizard or tortoise tribes, or any of the great mammalia. The native dog bears some resemblance to a mongrel fox-dog, and has some characteristics indicative of its being so—the effluvium, the tenaciousness of life, its silence when dying, and its peculiar short bark—which lead to the supposition that it is not indigenous, but a race derived from some shipwrecked animal. The human beings which have hitherto been found on the shores, or in the interior, are all of one species, and differ sufficiently in form to constitute a species distinct from any hitherto known. Some anomalies are evident, which belong to no other race. They have great and varied powers of mimickry, without having exhibited naturally any talent for constructiveness; though, when instructed, they have shown an aptitude for building. It has never been ascertained that they have a definite notion of a Supreme Being, who created them and all they see around them. They have neither idols nor sacrifices, prayers nor priests; which places them among the lowest known in the scale of human nature. Their perceptions are quick, and like other savage and wandering tribes, they can discover a track where the civilized man can see nothing to guide him. They are cunning, lively, and capricious; but with feelings of attachment which are to be improved, and a sense of want and inferiority which may be turned to good, both for the settlers and themselves, if patience and Christian charity are exercised towards a race whose country we seize, and whose hunting grounds, on which their existence depends, we enclose, to feed our cattle and grow our corn.

Ogle's Western Australia.

The Harmoniphon.—A musical instrument, lately invented by M. Paris of Dijon, has attracted much notice in France. It resembles the instrument called the *Concertina*, well known in London from the very clever performance of young Regondi; but it seems to be superior, in some respects, to the concertina. The sound is produced by the vibration of thin metallic plates, and it is played by keys like those of the piano-forte; but the air which acts upon the vibrating substances, instead of proceeding from bellows within the instrument, is blown *by the mouth*, through an elastic tube. The excellence of the instrument accordingly consists in this, that while the fingers on the keys merely mark the different notes of the scale, the *expression* lies in the mouth. It is the living breath of the performer which gives accent, articulation, and emphasis to the notes, as in the oboe or clarionet, and enables the performer to "discourse most eloquent music," in a manner which the production of sound by the mechanical contrivance of a bellows does not admit of. The *Harmoniphon* is made in three varieties: the first is of the compass of the oboe; the second, of the Corno Inglese; and the third (of a larger size than the others) combines both these instruments, and has a compass of three octaves. This instrument is highly approved by the French composers; and one of them, M. Adolphe Adam, has given an account of it in the *Monde Dramatique*, in which its capabilities are pointed out. It is calculated, in particular, to be of great utility in provincial orchestras, where it is an excellent substitute for the oboe—an instrument as disagreeable in the hands of an ordinary performer as it is delightful in those of a Grattan Cooke. Accordingly,

we are informed, the *Harmoniphon* has already been adopted in the orchestras of many provincial theatres and musical societies.

New mode of marking Linen.—A celebrated German chemist, Mr. Hoenle, has invented a new plan for marking linen without ink. This is effected by simply covering the linen with a fine coating of pounded white sugar. The stamp of iron very much heated is impressed on this material. Two seconds suffice for the operation. The linen remains slightly scorched, but the mark is indelible.

New alloys of Metals.—A curious and valuable discovery has just been made in the alloy of metals. A manufacturer of Paris has invented a composition much less oxidable than silver, and which will not melt at less than a heat treble that which silver will bear; the cost of it is less than 4d. an ounce. Another improvement is in steel; an Englishman, at Brussels, has discovered a mode of casting iron so that it flows from the furnace pure steel, better than the best cast steel in England, and almost equal to that which has undergone the process of beating. The cost of this steel is only a farthing per pound greater than that of cast iron. Mining Journal.

New source of Light.—M. Seguin has communicated to the *Acadamie des Sciences*, at Paris, a memoir on the distillation of animal substances, in which he states that he had reduced the process to such a degree of simplicity as to render it profitable for the sake of the products. From the carcass of a horse he obtained, by destructive distillation, 700 cubic feet of gas, suitable for purposes of illumination, 24 lb. of sal ammoniac, and 33 lb. of animal black. The gas was composed of one part of olefiant gas, and four of carburetted hydrogen, and might be preserved for months in contact with water, without being in any way injured, or its brilliancy, as a combustible, impaired. M. Seguin found that 3,234 cubic inches, when burnt for an hour, gave twice and a half as much light as a Corcet lamp.

Acacia.—The flowers of a species of the Acacia are used by the Chinese in making that yellow which bears washing in their silks and stuffs, and appears with so much elegance in their paintings on paper. They gather the flowers before they are quite open, and put them in a clean earthen vessel, over a gentle heat, and stir them continually, till they become dryish and of a yellow color; then to half a pound of the flowers they add three spoonfuls of clear water, and after that a little more, till there is just enough to hold the flowers incorporated together. They boil this for some time; and the juice of the flowers mixing with the water, it becomes thick and yellow. They then take it off the fire, and strain it through a piece of coarse silk. To the liquor they add half an ounce of common alum, and an ounce of calcined oyster shells reduced to a fine powder. All this is well mixed together, and produces the lasting yellow they have so long used. The dyers of large pieces use the flowers and seeds of the acacia for dying three different sorts of yellow. They roast the flowers, as before observed, and then mix the seeds with them, which, for this purpose must be

gathered when quite ripe; by different admixtures of these, they produce the different shade of color, only for the deepest they add a small quantity of Brazil wood.

New mode of Resuscitation from Drowning.—At the annual meeting of the Bristol Humane Society on Tuesday, the society's silver medal was presented to Dr. Fairbrother of Clifton, for his exertions in recovering a boy who had been under the water in the floating harbor a quarter of an hour, and another quarter of an hour had elapsed before the doctor could operate upon the body. The most remarkable feature in this case is the new mode by which Dr. Fairbrother succeeded in his laudable object; namely, by closing the boy's mouth with his finger, sucking off the foul air from the lungs through the nostrils, and promoting respiration by pressing on the abdominal muscles on the sides. The usual method is to inflate the lungs, but it is very seldom that persons are recovered by this method if they have been longer than a few minutes under the water. Berrow's Wor. Jour.

Carbonic Acid as a Moving Power.—Among the most attractive of the scientific novelties exhibited at the late meeting of the British Association at Newcastle, was the solidification of carbonic acid gas, by means of apparatus invented by Robert Addams, Esq. As this remarkable phenomenon has met with less attention in the newspaper reports than on the spot, we have requested Mr. West, who was present, to furnish us with a short account of the experiments. The apparatus consists of a strong wrought iron vessel, in appearance like a swivel gun, two feet long, and six inches diameter, suspended by trunnions on an iron frame; of a vessel similar in form and size, but mounted perpendicularly on a flat stand; and of two pumps, worked by powerful levers, together with the needful valves and connecting tubes. Into the generator, or suspended vessel, are put proper quantities of bicarbonate of soda and warm water; a long open tube is also inserted, containing sulphuric acid: the mouth is closed with a screw valve, and the generator being rapidly whirled round on its trunnions, the sulphuric acid flows out, and is mixed with the solution of bicarbonate of soda. The carbonic acid, disengaged, having no room to expand, is condensed into a liquid. So far the apparatus resembles that first employed for the same purpose by Monsieur Thellussier in Paris. But stopping short here, Thellussier could only make use of about one third of the carbonic acid disengaged; while Mr. Addams, by pumping it into the second vessel, obtains nearly the whole. On allowing this liquid carbonic acid to escape through a box, or hollow brass cylinder, into the atmosphere, the instantaneous evaporation of one portion causes it to absorb so much caloric as to solidify the remainder. The solid carbonic acid resembles in appearance and texture newly fallen snow, or small hail; it evaporates rapidly, but not instantly; from the atmosphere of gas around it preventing close contact, its intense coldness is not immediately felt; but the brass box in which it is collected, or the solid acid itself when long held, blisters the skin like a hot iron. By placing a portion of the solid acid on a few pounds of mercury, moistened with æther to improve the conduction,

the mercury soon becomes solid; and thus the freezing of mercury, an experiment which many chemists have never seen, is performed rapidly on a large scale, and with the greatest ease and certainty. Several curious experiments were shown by means of the frozen mercury; it was doubled up, and placed in water, which instantly froze, while the mercury returned to its ordinary state of fluid. But the most remarkable fact occurred accidentally; on touching a mass of cold iron, the mercury fused, and ran down from so good a conductor, like lead or tin in a furnace. Professor Graham did not speak too strongly, when he said that such an apparatus would become as needful in the laboratory for the production of cold, as a furnace for producing heat. But the circumstance of most consequence in relation to its practical employment is, that, at a temperature of 150° the liquid acid exerts an expansive force of 70 atmospheres, or 1,050 lbs. on the square inch; and every increase of a single degree of temperature augments the pressure by upwards of an atmosphere, or 15 lbs. on the inch. The iron cylinders are proved before being used, by a pressure of 150 atmospheres; and Mr. West states that, remembering the enormous power obtained, and observing the perfect ease and apparent safety with which this force is managed, he, contrary to his previous views, no longer considers the use of liquid carbonic acid as a moving power to be at all chimerical. Should it be so applied with success, our present locomotives would be discarded, stoppages for water would be needless, and on long lines of railway, or for long voyages, steam would be superseded by carbonic acid.

Leeds Mercury.

Artificial Incubation—The Eccaleobion. This is a contrivance for hatching eggs by artificial heat. It differs from the Egyptian method of artificial incubation by means of *mammals*, or ovens heated immediately by fire, which was tried in Paris by De Reaumur, and in London by Mr. Mowbray; and also from the more recent attempt at the Egyptian hall by means of steam. In what way the heat of the Eccaleobion is produced, we are not informed; probably it is by hot water; certainly the operation is simple and effective, as abundant living proofs testify.

In an oblong wooden case, about nine feet in length, and three feet in width and depth, entirely isolated, and divided into eight compartments, each closed by a glazed door darkened, the eggs are placed on cloth, without any covering; here they remain for twenty-one days, the period of incubation; at the expiration of which time, the chick liberates itself, and next day is running about and pecking its food as lively as if it had the hen's wings to shelter it. The Eccaleobion is capable of containing upwards of two thousand eggs, and of hatching about a hundred daily; and though some failures occur from natural causes, the machine, unlike the parent bird, never addles the egg.

It is always contrived that one compartment shall exhibit the last stage of incubation; and this being open, the visiter may not only hear the faint chirp of the imprisoned chick, but watch its attacks on its oval cell, till having broken the shell all round, it bursts the integuments and liberates itself. At first emerging into this new state of existence, the light and the human eyes gazing on the little chick, together with its extreme weakness, make it appear as if it would fain retire into its con-

finement again; it staggers, closes its eyes, and falls down in an apparently exhausted state, but soon revives, though but for a short time: as soon as it can take food, however, it gains strength rapidly. In the last stage of incubation, the egg may be held in the hand, or placed in a lady's bosom; where if any fair visiter be so minded, the chick may come to light.

In a case fitted with lenses, placed before eggs in different stages of incubation, lighted by gas, the appearances through the shell may be observed; and on a table are placed the contents of several eggs at successive periods of incubation, showing the formation of the embryo, from the first day (as seen under the microscope) to the complete bird, coiled up in its oval form. To trace the gradual development of the eyes, the bill, and cranium, the heart, and circulating system, the feet, feathers, &c. is exceedingly interesting.

The fledglings are placed in partitions and supplied with food, and the room rings with their chirping.

The Eccaleobion process is of course applicable to eggs of every species of bird, but none others than those of the common gallinaceous fowl have been reared: parties bringing the eggs of other birds, however, can have them hatched by the machine, as the same temperature (about 98 degrees of Fahrenheit) is applicable to all, from the wren to the eagle. The introduction of the Eccaleobion into general use, will supply abundance of fowls for the table, at a very cheap rate, and with little trouble; the machinery of the Eccaleobion is also applicable to a variety of scientific purposes, where an even and pervading temperature is required; as it may be regulated at pleasure up to 300 degrees of Fahrenheit. London Paper.

Note on Electro-Magnetism, by E. Lenz.—In the treatise which Professor Jacobi and myself have written in common on the electro-magnet, we have shown how each of the laws of the magnetic action of spirals upon soft iron, produces another limited but closely corresponding law, according to which, from the want of an iron centre, the stream is spirally evolved. Of these latter laws I have treated elsewhere, (*Mem. de l'Acad. des Sciences, T.* 2, 1833,) but there are certain restrictions which I will now more closely canvass.

I have in my treatise examined the law:—"In spirals of variously graduated circumferences, the electro-motive power of the streams induced from the same iron centre, and the same magnetism therein generated, is independent of the circumference of the spiral windings."

On the other hand, in our common treatise, we have proved that this law is true in the main, that the magnetism generated in an iron centre by a magnetizing spiral may be independent of the circumference of the spirals, but that this law suffers a limitation from those nearest the end of the iron centre; in which case the wider spiral may lose in comparison with the narrower. We have also there shown how this departure from the general rule may be accounted for.

The question now arises, since these laws in both cases correspond so closely, would this restriction of the general law extend also to the magneto electric stream? I believe that a doubt of this cannot exist, as the conclusion by which we explained the diminution of the magnet-

izing action on the increase of the spiral circumference, will apply, *passim*, also to the magneto-electric case.

Indeed, if we look at the figure referred to (Fig. 5, Taf. 2,) in which M N represent the iron centre, *a* and *a'* the transverse windings of two spirals upon one and the same level *a' a o*, but projecting at unequal distances from the iron—if, I say, we look at this, and suppose the magno-electric case that in M N, a magnetism appointed for all experiments, be suddenly withdrawn, a stream will thereby be generated in the windings *a* and *a'*; and this will not only be promoted by the magnetic elements of the iron in the plain *(ebene)* of both streams, but by others, weaker the further they are removed from *o*, in consequence of the greater obliquity of the windings. We assume that upon *a*, on the abstraction of the magnetism, the angle *m a n* describes a sensibly co-operating section, so also upon *a'* does the angle *m' a' n'* describe parts similarly influenced. Upon *a* and *a'* will the action be the same, as well in the electro-magnetic as in the magneto-electric instance; and with respect to *b* and *b'*, which are at the extremity of the iron, the effect will be equalized. But if the windings do not extend entirely to the end, but only approach it, as in *d* and *d'*, a portion of the section in *d'* will fail to co-operate, while in *d* none of the effect will be lost, and the influence on the wider spiral *d'* will also be necessarily weaker than upon *d*, even when the action is perfectly equal upon *a* and *a'*. The law of the electro-motive power of magneto-electrive streams applies particularly to iron rods of unlimited lengths,

But in such case the question arises how did it happen that in my earlier researches I did not discover this departure, small though it be, from the general law which renders the electro-motive power of magneto-electric streams independent of the width of the spiral windings? A closer consideration of the process will explain this.

In my former treatise I adduced two experiments in demonstration of the assumed law. In the first essay, the proportions of the diameters of the windings were = 0'', 73 : 6'', 57 ; on the second, 0'' 73 : 28'', 0. I will confine myself to the last, in which the proportion of diameters was as 1 : 40; what is admitted of this, is allowable in a yet greater degree of the other, in which the proportion was only = 1 : 9. The induction of the streams in those spirals was so managed, that the spiral of 28'' diameter, consisting of six windings, which had been wound closely together round a wheel of this diameter, and drawn on to an iron cylinder of about half an inch in diameter and two inches long, at the end of which two powerful magnetic systems were placed, so that the iron cylinder became highly magnetized, and on the sudden removal of these two systems, the stream was generated in the spiral. Thus the two systems, each of which being 19½ inches long, placed in opposition with the cylinder, formed a magnet 41 inches in length, round which the spiral wound, its distance from the same being only 14 inches; the angle therefore described by *m a n* was of 112°. On the sudden withdrawal of the two systems, the magnetism of this entire angle is preserved; and not only the 2-inch iron cylinder, but also the two 19½-inch magnets act upon the spirals. We therefore find why the imperfect co-operation of the end of wider spirals did not show, if we admit that active magnetic elements existed within the angle of 112°, which is certainly most probable.

After these explanations I must hence modify (as being assumed *too general* in the treatise alluded to) the law presuming the electro-motive power of the magneto-electric streams independent of the diameter of the spiral windings. It becomes therefore necessary to qualify by saying, *that it is only effective generally when the inducing magnetic rods are to be considered with respect to the width of the spiral windings as interminable, but that upon short magnetic rods the limitation exists; that the comparison of the effects of spirals of different degrees of diameter is in favor of the less.*

Precisely the same remarks, which I have just made upon the width of the windings of magneto-electric spirals, are applicable to the other law presumed by me in the treatise already quoted; that the electro-motive power in the magneto-electric spirals is proportionable to the number of the windings. Also here, in the case of the shorter inducing magnets, must the end windings evolve a somewhat smaller electro-motive power. The reason why this was not shown in my former experiments was partly attributable to the spiral closely surrounding the iron cylinder, and partly to the circumstance of the windings being affected not only by the abstraction of the magnetism of the iron cylinder, but also by the removal of magnets of horse-shoe iron, whereby the inducing magnet is, as it were, lengthened. It is not necessary to enter further into detail in this case, as it is entirely analogous with that just considered, only a horse-shoe iron magnet is employed instead of the two rectilinear systems.

Thus even here is it requisite to modify the law, which assumes that the electro-motive power is proportionable to the number of the windings, as, strictly speaking, it is only cognizable when such magnets are employed as, in proportion to the width of the windings, may be considered interminable. It would be better expressed thus: The electro-motive power of a charged spiral is equal to the sum of the electro-motive powers of single windings collectively. Poggendorff's Annelen der Physik.

Ancient Inks—According to the Roman naturalist Pliny, and other authors, the basis of the ink used by ancient writers, was formed of lamp-black, or the black taken from burnt ivory, and soot from furnaces and baths. Some have also supposed that the black liquor which the cuttle-fish yields was frequently employed. One thing is certain, that whatever were the component ingredients, from the blackness and solidity in the most ancient manuscripts, from an inkstand found at Herculaneum, in which the ink appears as a thick oil, and from chemical analysis, the ink of antiquity was much more opaque, as well as encaustic, than that which is used in modern times. Inks of different colors were much in vogue: red, purple, blue, and gold and silver inks, were the principal varieties. The red was made from vermillion, cinnabar, and carmine; the purple, from the murex, one kind of which, called the purple encaustic, was appropriated to the exclusive use of the emperors. Golden ink was much more popular amongst the Greeks than amongst the Romans. During the middle or dark ages, the manufacture both of it and of silver ink was an extensive and lucrative branch of trade, and the illuminated manuscripts which remain are a striking proof of the high degree of perfection to which the art was carried.

The making of the inks themselves was a distinct business; another connected with it, and to which it owed its origin, was that of inscribing the titles, capitals, as well as emphatic words, in colored, and gold and silver inks.

Ayr Courier.

On the separation of Lime from Magnesia, and on the assay of Gold. By Lewis Thompson, Esq. M.R.S.C. Communicated by the author.

TO SEPARATE LIME FROM MAGNESIA.

Dissolve the combined earths in dilute nitric or muriatic acid, and precipitate the filtered solution by means of an excess of carbonate of soda; dry the precipitate, and place it in a coated green glass tube, so disposed that the whole can be heated to a dull red heat; when red hot, pass a current of well-washed chlorine through the tube for a few minutes: the lime will be converted into chloride of calcium, but the magnesia remains unacted upon. When the whole is cool, remove the mass from the tube, and boil it for a minute or two in water, filter the liquid, and wash the insoluble portion (which is magnesia) with water, and precipitate the lime from the mixed liquors by carbonate of soda. The heat should not exceed a dull red, as the mass is apt to become vitrified at the part which touches the tube, and this renders it difficult to remove the contents.

TO ASSAY GOLD.

Take six grains of the gold to be assayed, and place it in a small crucible, with 15 grains of silver, and from 8 to 12 grains of chloride of silver, according to the supposed impurity of the gold; lastly, add 50 grains of common salt, (chloride of sodium) reduced to a fine powder, so as to prevent decrepitation; fuse the whole together for five minutes, and allow it to become cold; then take out the metallic button and beat it into a thin plate, and subject it to the action of dilute nitric acid as in the ordinary mode of parting. By this plan, the tedious process of cupellation is avoided, the baser metals being wholly removed by the chlorine of the chloride of silver, and their place supplied by pure silver.

Philosophical Mag.

Report on an improved process for the calcination of Copper Ores.— At the request of Messrs. Benson, Logan & Co. we attended at their copper works, near Swansea, to examine the working of Mr. Throughton's patented mode of calcining copper ore, and preventing those prejudicial effects which result to vegetation from the method hitherto generally adopted of calcining the ore in reverberatory furnaces, and permitting the whole of the gases and vapors to pass into the atmosphere.

Mr. Throughton's plan, as patented, consists of calcining copper ore in retorts, which are heated externally: by this arrangement, the gases and vapors from the ore are kept separate from the products of the combustion of the fuel, and can be treated with water to condense them without interfering with the draught of the furnaces.

We found that the calciner in operation was fitted up on a practical scale, and we were informed that it had been in use for the last two years, during which time it had required little or no repair. It consisted of twelve earthenware retorts, and four small furnaces, the heat

of which passed first along the under sides or surfaces of the retorts, and afterwards over the upper surfaces, thus heating them below and above in a very equal and effectual manner, from which circumstance the operation of calcining occupies only six hours for each charge. The twelve retorts are capable of receiving about two to two and a quarter tons of copper ore at once; consequently the twelve retorts calcine from eight to nine tons of ore in twenty-four hours. For this we found that free burning coal alone was sufficient, and that the consumption for eight to nine tons of ore was thirteen cwt.; whereas, we are informed, that, according to the present method of using reverberatory furnaces, for each eight tons of ore calcined, from thirty to thirty-five cwt. of coal, of which two-thirds are free burning, and one-third binding, are consumed. The patented plan, therefore, offers considerable advantages in saving fuel, as well as in its more immediate object, that of preventing the injurious effects produced by sending immense quantities of sulphuric and sulphurous acids into the atmosphere.

The mixed ore used in our trial consisted of one-third Connoree, one-third Knockmahon, and one-third Cornish. It was subjected to analysis, and found to consist of very nearly—

Copper	9
Iron	20
Sulphur	14
Oxygen, earthy matter, and arsenic	57—100

On analyzing the ore, after calcination, it yielded about 10 per cent of sulphur, 4 per cent having been driven off in the operation, consequently, eight tons of the ore would have lost above 700 lbs. of sulphur, and this, according to the common mode of calcination, would have been thrown into the atmosphere in the forms of sulphurous and sulphuric acid; and a quantity of these, amounting to more than 1500 lbs. must be spread over the surrounding country in twenty-four hours from the quantity of ore specified. So powerful is the effect of these vapors, that it is impossible to respire for a moment air in which they are diffused even in very minute quantity; but it was proved that the gaseous products from the retorts, after being acted on by water, according to Mr. Throughton's plan, were quite innoxious, and might be breathed with impunity, several persons having, in our presence, introduced their heads into the flue through which the purified air was passing, and kept them there for a considerable time without suffering the slightest inconvenience.* The ore used contained some arsenic, which was volatilized with the sulphur; and as the vapor of arsenic is more readily acted on than the acids of sulphur by water, it could not escape when they were condensed.

We may here observe, that we are aware the condensation of the sulphurous vapors from copper ore has been before attempted, by submitting the products of combustion, together with those of the calcination of the ore, to the action of the water; but we believe that it would be impossible to use sufficient water for such a purpose without injuring the draught of the furnaces, in addition to the much greater

* Among others, Mr. Phillips repeatedly and successfully made trial of this very efficient test of the absence of sulphurous acid, and could scarcely perceive a trace of it, and was satisfied no appreciable quantity escapes into the air.

expense which would be incurred by having to act on a so much larger quantity of heated air.

In the patent plan, however, this defect is remedied, by conveying the products of the combustion of the coal through a different flue from that which conveys away the vapors evolved from the copper ore; and while water is thus effectually applied to the latter in its particular channel, the draught of the furnaces and of the flues which conduct the coal-smoke is wholly unimpeded by it.

It is well known that the chimneys of the calcining furnaces emit a very large quantity of white vapor, which is in fact sulphuric acid; but it is to be observed, that the sulphurous acid, which is invisible, also produces destructive effects upon vegetation, for it is not only injurious in itself, but by exposure to air and moisture, it is converted into the more powerful sulphuric acid. Great, therefore, as is the damage produced by the sulphuric acid, that resulting from the sulphurous acid must be still greater.

On analyzing the vapors of the copper ore, it appeared that the proportion of sulphurous acid was to that of the sulphuric acid upwards of three to one.

The quantity of water used in condensing the vapors from the copper ore, as practised according to the patented plan, was found to be at the rate of 13½ cubic feet, or about 837 lbs. per minute.

This quantity might be greatly diminished by an improvement which has been suggested in the mechanical mode of its application; and it should be remarked, that the water is so very slightly impregnated with the acid vapors, that it may be again and immediately employed in a succession of apparatus for washing and condensing additional quantities of vapors from other retorts.

The quantity of water employed will, we conceive, be found to be objectionable, as a small portion only of the fuel saved in the process of calcination will be required to obtain the steam power necessary to keep up the supply; for it will be seen that, even supposing that the 837 lbs. of water per minute were not used a second time, and admitting it would be necessary to raise the water fifteen feet, each furnace capable of calcining eight tons of ore in twenty-four hours, would require a power rather exceeding one-third of a horse power, and taking a consumption of ten lbs. of coals for each horse power per hour, there would have to be deducted from the coal saved in the process of calcination about 90 lbs. for the power required to supply the water. We have supposed it requisite to raise the water fifteen feet, because we consider that to be an extreme case; but, probably, in many instances, a direct flow might be obtained; and we would also state, that we conceive there is no objection to the use of sea-water.

After the most careful consideration of the subject, we are of opinion that the invention is new, and decidedly successful, and that it is not only deserving the attention of the owners of copper works, as offering an economical mode of carrying on the process of calcining copper ore, but that it is also of the highest importance to the land-owners and the public in the vicinity of copper works.

R. Phillips, *Mus. of Econ. Geol.*
W. Carpmael.

London, Dec. 1839.

Important Discovery in the Art of Printing.—A few weeks ago it was announced, through the medium of the public journals, that a new and important process of transfer printing, which bids fair to revolutionize a large portion of the printing and publishing world, had been discovered by the Messrs. Dupont, of Paris. By means of this new process, copies of old or new books, engravings, &c. can be multiplied, it is said, to any number. This is effected by spreading a secret composition over the page or engraving of which copies are wanted, which is then laid face downward on the lithographic stone, and by a powerful pressure the stone retains, "with scrupulous precision," the printed characters of the original page or engraving. "It is then covered," says the account, "with the same preparation, and it may then print thousands of copies by the ordinary processes of every sort of lithography. Five minutes suffice for both operations. The original engraving may be restored to the portfolio which supplied it, for it has not been in the slightest degree injured: the book, thus wholly reprinted, may undergo another binding, and honorably resume its place in your library."

The page of a book, newspaper, or an engraving, while the oily ink is still wet, but *only then*, can be transferred to stone, and by this means reproduced to any number This is practised in many places by lithographers; but hitherto it has been found impracticable to transfer prints after the ink or oily substance has evaporated. Now that the discovery of the Messrs. Dupont has been announced to the world, we can confidently promise them a tough rival in the person of our townsman, Mr. Ambrose Blacklock, surgeon, whose dexterity in similar manual departments, as well as in others of a different nature, are well known, not only "hereaboots," but "far awa'." For a certain period past, his attention has been particularly directed towards discovering and perfecting a method by which the certainty of this extraordinary and important art may be secured. The idea and discovery originated entirely in his own mind; and, although at an early progress of his experiments doubts were expressed as to their ultimate success, scarcely any such can *now* be entertained—the specimens we have seen being so accurately delineated as regards body and outline, with the exception of a small proportion of what is termed by the profession *blurring*, that we can safely assert, that the art, in Mr. Blacklock's management, has already almost arrived at perfection. How far the art itself may go when once placed in the hands of persons of professional experience—Mr. Blacklock, we believe, possessing no more of this than what was necessary in working out his own ideas—we will not venture to speculate; but at present we can confidently say, that the infant art presents high promise of future excellence. The effects of this discovery, to speak without exaggerating, can scarcely fail to be astonishing, considering the real cheapness of many of our present reprints; but on this point we will allow Mr. Blacklock to speak for himself:

"I believe—but my specimens must speak for themselves—that I have already brought this novel and important art to perfection; and it is quite impossible to foresee its effects upon literature and the fine arts. Foreign works and engravings may, in this manner, be reprinted on their arrival here, without the expense of setting up types or engraving

plates. In the same way our own books, the copyright of which has expired, may be re-issued at a rate which the cheapest of our reprints would fail to compete with. Bibles, &c. in the Indian languages, and in others whose character are so *outré* as to defy the art of the type-cutter, might, when once printed by the ordinary process of lithography, be reproduced so readily as to make the want of type a matter of little moment. Considerable benefit will, in all probability, accrue to our potteries. At present the number of designs which ornament the wares is very limited, as the engraved plates from which the recent impressions are transferred to the biscuit are so high-priced that a great variety of them cannot be kept by the china manufacturer. But, desirable as it may be when applied as above mentioned, I think it will be found of still greater importance in reprinting logarithmic tables, and other sets of calculations, on the accuracy of which, when applied to navigation, thousands of lives, and the security of so much valuable property, constantly depend."

Since writing the above, we learn that a number of scientific gentlemen and others are now turning their attention to this new discovery; and so great is the interest already excited, that many of our first lithographers are on the eve of negociating with Mr. Blacklock for the disclosure of his magic composition. That such would very early be the case, we never doubted; and when once the enterprise and practical ingenuity of our mechanists have laid hold of the secret, it will not be long ere we have first-rate specimens of it placed before the public.

Dumfries Courier.

Anticipated results from the Daguerreotype.—What we may yet expect from the Daguerreotype is finely shown by the philosophic Arago: To copy the millions and millions of hieroglyphics, which entirely cover the exteriors of the great monuments at Thebes, Memphis, Carnac, &c. would require scores of years, and legions of artists. With the Daguerreotype, a single man would suffice to bring to a happy conclusion this vast labor. Arm the Egyptian Institute with two or three of Daguerre's instruments, and on several of the large engravings in that celebrated work, the fruit of our immortal expedition, vast assemblages of real hieroglyphics would replace fictitious or purely conventional characters. At the same time, these designs shall incomparably surpass, in fidelity and in truth of local color, the works of the ablest artists. Again, these photographic delineations having been subjected, during their formation, to the rules of geometry, shall enable us, with the aid of a few simple data, to ascertain the exact dimensions of the most elevated parts, and of the most inaccessible edifices. The preparation employed by M. Daguerre is a re-agent much more sensible to the action of light than any other hitherto in use. Never have the rays of the moon, we do not say in a natural state, but even when concentrated by the most powerful lens, or in the focus of the largest reflector, been capable of producing any perceptible physical effect. The plated discs prepared by M. Daguerre, on the contrary, receive impressions from the action of the lunar rays and the succeeding operations to such an extent as permits the hope that we shall be in a situation to make photographic charts of our satellite. In other words, in a few minutes we shall be able to execute one of the longest, most tedious,

and delicate operations of astronomy. Let us not hesitate, then, to announce the fact, that the re-agents discovered by M. Daguerre will speed onwards the progress of those sciences which confer the highest honor on the human mind. By their aid, the philosopher will be enabled henceforth to proceed on the principle of absolute intensities ; he will compare lights by their effects. If he find it useful, the same tablet will present him with the impression of the dazzling beams of the sun, and with the penciling of rays three hundred thousand times fainter than these of the moon—the rays of the stars. In short, when observers apply a new instrument to the study of nature, what they expected from it has always proved little indeed, compared with the series of discoveries which the instrument originated. In this instance, it is upon the unforeseen that we are especially to reckon.

Improvement in the manufacture of Iron.—The particulars of an improved process in the manufacture of iron are given below from the specification of the patentee, Mr. Heath. Every proposition which bears upon this great manufacture is, of course, deserving of notice, and we shall be glad to receive further particulars of this new process, which has the novel feature of dispensing with the use of fluxes altogether.

Josiah Marshall Heath, Allan Terrace, Kensington, for certain improvements in the manufacture of iron and steel: Oct. 4th. This invention consists, first, in the extraction of pure cast iron from the ore, without the intervention of any earthy, alkaline, or saline matter, to form a vitreous flux, cinder or slag; second, in producing cast steel by fusing pure cast iron so obtained, along with malleable iron, or certain metallic oxides, in such proportions as may decarburate the cast iron to a certain degree; and in carrying the process of decarburation to the further extent desired, by cementation with metallic oxides, without any admixture of carbonaceous matter; third, in the use of oxide of manganese, without mixture of any other substance, in the process of converting cast into malleable iron, by the process of puddling; and fourth, in the use of carburet of manganese to make common blistered steel into cast steel.

Malleable iron is at present produced either by smelting the richer iron ores with just as much charcoal or other carbonaceous matter as is adequate to abstract all the oxygen from the ore, and bring the ore into the malleable state; or by smelting the poorer ores, called "ironstones," in contact with carbonaceous matter, in such excess as to form with the metal the compound called carburet of iron by chemists, and cast iron by manufacturers; and then separating the carbon by a distinct and subsequent process. By the first process, malleable iron of very unequal quality in its different parts is produced; and by the second process, a cast iron is obtained, which is contaminated to a very considerable degree with sulphur, phosphorus, arsenic, silicon, aluminum, calcium, and other foreign substances. A pure native oxide, or carbonate of iron, is alone capable of producing a pure metal convertible into good steel; but such pure ore has been hitherto debased and deteriorated in the smelting, by mixture with earthy, saline, or alkaline matters, under the name of fluxes, added with the intention of promoting

the reduction of the metal, and of protecting it when reduced from the oxidizing influence of the blast.

After an extensive course of experiments, Mr. Heath has discovered that such earthy fluxes are not necessary. His operation is commenced by charging the blast furnace successively with coke, charcoal, or other suitable fuel, leaving the tap hole open that the flame of the fuel, urged by the blast, may play in all directions, so as to bring the whole interior of the furnace into an uniform state of incandescence. When the furnace is thus charged, the tap hole is closed, and 20 lbs. of ore are thrown into the furnace for every 100 lbs. of fuel. The furnace is charged at this rate for about twelve hours, when the melted metal is run off into pigs. After this first discharge or casting, the ore is added at the rate of 25 lbs. for every 100 lbs. of fuel, for a second period of twelve hours, when a second casting of pig iron is run off. After this second discharge, ore is added at the rate of 30 lbs. for every 100 lbs. of fuel, during a third working of twelve hours; and thus, in each successive period of twelve hours the quantity of ore is increased at the rate of 5 per cent. of the weight of the fuel, till eventually the proportion of ore amounts to about 65 or 70 lbs. for every 100 lbs. of fuel. By proceeding in this way, and by throwing in the ore merely reduced to the size of peas, or thereabouts, but not roasted, if the furnace be well attended to by the workmen, it will turn out about 50 lbs. of pure pig iron for every 100 lbs. of fuel consumed.

To convert the carburet or cast iron, thus produced, into steel of any degree of hardness, it is melted in a cast iron or cupola furnace, by the heat of coke or other fuel; but, in all cases, no more fuel is used than is requisite to melt the iron, so, that the oxygen of the blast shall serve to burn away the carbon of the carburet to a considerable degree, while a further portion of the carbon is neutralized or removed by the addition of scraps of metallic iron, or by the oxides of iron or of maganese.

To produce a superior cast steel from the pure cast iron, sesquioxide of maganese, which has been previously ignited, is introduced in quantities not exceeding 5 per cent. into the cupola; no more fuel is used than the blast can readily burn into carbonic acid, otherwise the excess of the carbonaceous flux would deoxidize the maganese, nullify its decarburetting action upon the cast iron, and thus prevent it from reducing the metal to that lower stage of carburet which constitutes cast steel. Sometimes, for the same decarburretting purpose, a portion not exceeding 5 per cent. of chromic ore may be used. When the decarburation has been carried in the cupola, to the proper pitch, the steely metal is to be run out, and cast into iron moulds. The ingots thereby formed are now to be converted into steel of any desired degree of mildness by a further process of decarburation, which consists in stratifying the said ingots along with peroxide of iron, or peroxide of manganese, without charcoal, in a steel cementing furnace, which should be lined with sheet iron, if it is constructed of fire bricks or stone, to prevent the action of the peroxides upon the stones or bricks of the furnace. The ingots are to be here subjected to a cementing heat for a certain period, proportional in duration to the softness required in the metal.

Mr. Heath further improves the quality of malleable or bar iron, by adding to the pig or plate iron in the puddling furnace, while in fusion,

from one to five per cent. or thereabouts, of any pure oxide of manganese, the sesquioxide being preferred.

An improved quality of cast steel is made by putting into a crucible bars of common blistered steel, broken as usual into fragments, along with from one to three per cent. of their weight of carburet of manganese, and exposing the crucible to the proper heat for melting the materials, which are, when fluid, to be poured into an ingot mould in the usual manner. Mining Journal.

Civil Engineering.—It appears that before the University of Durham (which, by the way, is one of the most deserving public institutions in the country) made civil engineering a part of its studies, a college of civil engineers had been commenced in London. Mr. Wallace, of Blythswood Hill Academy, whose lucubrations we have often seen with much effect in the Glasgow Chronicle, has recently addressed a letter to that journal, in which he enters with his well-known spirit and learning into this subject. He shows how important it is in connection with steam, and that some of the old institutions in Scotland are arranging courses of lectures upon engineering separately from their usual classes. But the most useful point in which we view this institution is from the principle laid down of allowing parents to pay a small annuity for a pupil at any age below 14, and that he shall be admitted at that age for five years at least *free of charge.* There is also to be an evening class for the benefit of working engineers; and out of this class, we presume, ten young men, who have displayed extraordinary ability, are to be periodically selected to enjoy the whole advantages of the institution. This sort of institution, and the more practical branches taught at Durham and at the London University, will soon work a strange and probably unexpected reformation in the old nests of classics and debauchery, mathematics and corruption, at Oxford and Cambridge. Indeed, we consider such an institution much better than if professorships should be established in separate institutions. There will be a concentration and an interest in such a gathering together of eminent youths in the metropolis, as well as a degree of emulation, and an excelling of each other, which never could have occurred in institutions where there were merely professorships. Besides, let it be observed that all usual learning is to be taught, the only difference being that practical science is to be the leader, not—as in most other institutions—the follower. Tyne Mercury.

March of Intellect.—The catalogue of this autumn's book-fair, at Leipsic, which may be regarded as a fair index of the literary and scientific activity in Germany, during the last six months, announces 4071 new works published by 518 booksellers. The number published in the summer half-year of 1829, was about 3000, and that of the corresponding period in 1819, only 1300. It is said, in a letter from Leipsic, that this increase, judging from the business which is doing by printers and booksellers, will still go on in a similar proportion.

Gunpowder.—Before the invention of gunpowder the number of castles, erected chiefly as places of security, was very great; but since,

few have been built, and these have not been as places of defence. There were 1,100 castles built in England between the years 1140 and 1154.

Fuel for Steam purposes.—A new description of fuel for steam purposes has lately been invented by Mr. Stirling, of Limehouse; and an experiment to prove its superiority over even the best Welsh coals, was made last Saturday, at the furnaces of Messrs. Fairbairn, engineers, at Mill Wall, Bankside, London, under a high pressure engine, during the long period of eleven hours, with the most perfect success. The saving in fuel alone was not less than twenty per cent. in comparison with that description of the best coals commonly used in the works of these gentlemen; and the space occupied by Mr. Stirling's fuel was also one third less than that usually set aside for coals. The Lords of the Admiralty have directed another experiment to be made of the properties of this fuel, at Deptford; and, should it be equally successful, a new era will speedily be created in steam navigation; the superiority of Mr. Stirling's invention being made manifest in a considerable saving in expense, in the creation of a much more powerful heat than can be raised from coals, and, what is still more important, in an immense saving of room on board ship. Mining Journal.

NOTICES OF NEW PUBLICATIONS.

The American Farmers' Companion.—This work, devoted as the name indicates to the farming interests of our country, is published monthly by Messrs. Wilson and Rogers of Philadelphia. It is a valuable compendium upon agriculture and subjects immediately connected therewith, and its cheapness, which in these days should be rated a merit, places it within the reach of every tiller of the soil, whether farmer or farmer's laborer.

Silliman's Journal for January, February, and March, has been received. So high a character, has this periodical obtained that the only opinion respecting it, is, it would deserve, if it were not *above*, all praise. The present number contains many valuable additions to science and the arts, and one modest pleasing flower from the more genial walks of literature, which blooms not the less freshly because it inhabits a nook in

"The snow crowned peak of science."

We refer to the "account of the capture and death of an alligator," which, for happy description of incident and scenery, may vie with the best productions of its day.

The Scottish Patriot, is the title of a new candidate for public favor generally, and the favor of Scotia's sons especially. It is ably conducted, and has for one of its objects the advancement of the arts, manufactures, and science.

Hunt's Merchants' Magazine flags not in its efforts to serve the class whose interests it professes to advocate. Nor are these efforts vain, as its enriched pages will show on the one hand, while on the other may be seen a due share of substantial public favor, which is not merely a life but a soul.

UNITED STATES PATENT OFFICE.

We have been favored with a copy of the report of H. L. Ellsworth, Esq. Commissioner of Patents, made to the United States Senate, showing the operations of the office during the year 1839, from which we extract the following:

Four hundred and twenty-five patents have been issued during 1839, (including eight additional improvements to former patents.)

During the same period, three hundred and three patents have expired.

The receipts of office for 1839 amount to $37,260, from which may be deducted $5,769, paid on applications withdrawn.

The ordinary expenses of the Patent Office the past year, including payments for the library and agricultural statistics, were $20,799 95, leaving a surplus of $11,450 43 to be credited to the patent fund.

For the restoration of models, records, and drawings, under the act of 3d March, 1837, $7,973 57 have been expended.

The receipts of the office would have been nearly $2,000 more, had not the late law permitted assignments to be recorded without charge, a gratuity, however, which has given much satisfaction.

In compliance with the act of 3d of March, 1839, I have published a digest of all patents granted by the United States, adding thereto an alphabetical index, and shall deposite in the Library of Congress nine hundred copies of the same.

The old digest was very defective. A new arrangement has been made, giving to each invention its appropriate classification.

A distribution of the new digest, will materially lessen the correspondence of the office and guard citizens against the impositions of venders of spurious patents. The volume contains above seven hundred and fifty pages.

The work was deemed necessary for daily reference in the office, and believing the appropriation adequate to cover the expenses, I did not delay the publication.

A small additional appropriation from the patent fund will be required to complete payment for the same.

Eleven thousand five hundred and nine patents have been issued by the United States previous to January, 1840.

A large number of applications, partially completed, are awaiting the reception of models and treasury fee.

The transmission of models through agents appointed by law in the several states affords much facility to inventors: and if permission were given to deposit with collectors of public revenue the fees required, such accommodations would obviate one cause of perplexity and delay, and be more especially convenient in consequence of their present agency in forwarding such models.

I am happy to say the Patent Office building is so far completed as to afford, within a few weeks, the necessary accommodation for the office, and to enable the commissioner to receive the numerous specimens of American art as contemplated by the act of reorganization, and to carry out the wishes of congress by collecting and distributing valuable seeds; exhibiting also, under appropriate classifications, the most important varieties, both exotic and indigenous.

The inquiries propounded by the honorable Secretary of State, in taking the next census, rendered it necessary for the Commissioner to expend but a small part of the appropriation for procuring agricultural statistics. From data of so high a source, the Commissioner can safely predicate future calculations, and hopes to present to Congress such details of domestic products, as will be of importance in financial estimates.

The diplomatic corps of the United States residing abroad, have been solicited to aid in procuring valuable seeds, and the officers of the navy, with the approbation of the honorable Secretary of that department, have been requested to convey to the Patent Office, for distribution, such seeds as may be offered. In many cases no charges will be made for seeds. If small expenses do arise, they can be reimbursed by appropriations from the patent fund, daily accumulating, and consecrated specially to the promotion of the arts and sciences.

The cheerfulness with which the diplomatic corps and the officers of the navy have received the request of this office, justify sanguine anticipations from this new undertaking.

With the additional assistance granted last session, and correspondent exertions on the part of those connected with the bureau, the business in each branch is brought up. Less delay will, I trust, arise in future applications.

The number of caveats issued in 1839 was two hundred and twenty-five.

The number of applications for patents the same year exceed eight hundred. One half of these have been rejected on examination. That the investigations of the office have not been conducted without care and attention, may perhaps be inferred from the fact that no appeal has been taken from the decision of the Commissioner on these cases. These rejections will show patentees, that they are protected from interference, to a great extent, and the public generally, how much they are guarded against useless or invalid patents.

I only add that a small appropriation will be required to continue present periodicals taken at the office, together with some additional standard works which are needed for daily reference.

LIST OF AMERICAN PATENTS,

Granted from March 25th, 1840, *to April 11th,* 1840.

Orren McCluer, Fredonia, N. Y. Improvement in Saddles. Patented March 25th, 1840.

Baxter D. Whitney and *George W. Lawton*, of Winchendon, Mass. Machine for stretching cloth in the process of fulling. March 25th, 1840.

Edward Gray, of Ulysses, N. Y. Improvement in the Grist Mill. March 25th, 1840.

John S. Gilbert, New-York. Improvement in the Floating Dry Dock. March 25th, 1840.

Edward Robbins and *William Ashby*, Bordentown, N. J. Improvement in Water Wheels. March 25th, 1840.

Mahlon Gregg, Philadelphia, Pa. Improvement in Bedsteads. March 25th, 1840.

William Bryant, Davidson county, Tenn. Improvement in Ploughs. March 31st, 1840.

Joseph Bolton Doe, London, England. Improvement in Soap-Frames. March 31st, 1840.

Charles Lombaert Philadelphia, Pa. Improvement in Machines for removing snow from railroad tracks. March 31st, 1840.

Samuel H. Bean, Philadelphia, Pa. Improvement in the Rocking Chair. March 31st, 1840.

Sands Olcott, New Hope, Pa. Mode of preparing flax and hemp, preparatory to the various processes of cleaning and separating the fibres, &c. March 31st, 1840.

Ezra R. Benton, Ohio City, Ohio. Mode of constructing bails and drivers for grist-mills. March 31st, 1840.

Daniel Treudwell, Cambridge, Mass. Improvement in the condensing apparatus for steam-engines. March 31st, 1840.

James N. Troville, Christiansburgh, Va. Mode of preparing white-lead paint. March 31st, 1840.

Jacob B. Eversole, St. Louis, Missouri. Improvement in steam boilers. March 31st, 1840.

Miles C. Mix, Tompkins county, N. Y. Machinery for removing stumps and other heavy bodies. March 31st, 1840.

Jesse Hubbard, Watertown, Conn. Mode of oiling and protecting mill spindles from dirt. April 8th, 1840.

Samuel Talbott, Richmond, Va. Improvement in brick machines. April 8th, 1840.

John Scott, Philadelphia, Pa. Improvement in Stoves. April 8th, 1840.

Samuel Moore, Chambersburgh, Pa. Self-regulating and self-oiling mill-bush April 8th, 1840.

William Dripps, Coatesville, Pa. Improvement in chairs for holding the rails of railroads. April 8th, 1840.

Jonathan Knodle, Bakersville, Md. Improvement in constructing combined ploughs. April 8th, 1840.

George Stocker and *Joseph Bentley*, Birmingham, England. Improvement in fire-arms. April 8th, 1840.

Abel Post, Henrietta, N. Y Improvement in the breast-plate harness for horses. April 8th, 1840.

Chauncey Crain and *Evert L. Wemple*, Madison, N. Y. Platform Balances. April 8th, 1840.

Asa Copeland, Bridgewater, Mass. Improvement in Cotton Gins. April 8th, 1840.

John L. Clarke, Nashua, N. H. Improvement in brakes for railroad carriages. April 11th, 1840.

Sands Olcott, Philadelphia, Pa. Machine for washing and cleansing various descriptions of yarn. April 11th, 1840.

Sands Olcott, Philadelphia, Pa. Machine for reducing the fibres of flax and hemp to a uniform length, so as to enable them to be spun with facility. April 11th, 1840.

DESCRIPTION OF PATENTS.

Improvement in the Construction of Saddles. By ORREN MCCLUER.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is the manner of attaching the leather or other covering of the seat of the saddle, (Fig. 1,) to the bow, (Let. A,) or to the straining web, (Let. C,) and extending a flap of leather, being of the same piece with the skirt, (Fig. 2,) from the pommel or head of the saddle, (Fig. 4,) so as to lap over the foregoing cover, by which means the whole weight of the rider rests entirely upon the spring; while in ordinary saddles, where the leather covering extends over the whole saddle, the weight is supported by the leather in a great measure, so that the spring does not operate as well, the whole being constructed as herein described."

Improvement in the Machine for Stretching Cloth in the Process of Fulling. By BAXTER D. WHITNEY and G. W. LAWTON.

CLAIM.—"We claim stretching the cloth width-wise, during the process of fulling, or after it is fulled and steamed, by means of the right and left threaded screws, D E, E F, (Plate 2, Fig. 1,) or fluted segments G, H, I, K, (Plate 2, Fig. 2,) in manner as above described."

Improvement in the Grist-Mill. By EDWARD GRAY.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is placing a pair of small stones in the eye of the runner, turning in opposite directions to each other, for grinding quicker near the centre, and thus preparing the grain for the large stones, which are thereby enabled to grind it into flour more easily and expeditiously, than without such previous preparation as herein described."

Improvement in the Floating Dry Dock. By JOHN S. GILBERT.

CLAIM.—" First. The employment of a boat-gate, in the manner described, for the purpose of dividing the machine into two compartments, in the manner and for the purpose described.

" Secondly. The manner of employing moveable loaded or ballast cars, which are made to run upon suitable rails or ways, situated on the platform, extended out for that purpose, in order to regulate the centre of gravity of the apparatus, as described.

" Thirdly. The particular manner of uniting or putting together the timbers of uniform size, for the construction of the platform and of the sides of the dock, which saves the expense of building stages, as set forth and represented in Fig. 7, whether said sides be made stationary or moveable."

Improvement in the Construction of Water Wheels. By EDWARD ROBBINS and WILLIAM ASHBY.

CLAIM.—" What we claim, therefore, as of our invention, and desire to secure by letters patent, is the employment of valves in buckets of water-wheels, such valves having the position herein described and represented in the accompanying drawing, and being used in combination with the openings through the soling of the wheel; that is to say, said valves forming an angle of 130°, more or less, with the radiating buckets, or with the radii of the wheel, and closing against its soling immediately above the openings for the escape of air; the whole being constructed and operating substantially in the manner set forth."

Improvements in the manner of fastening Bedsteads, and attaching and stretching Sackings. By MAHLON GREGG.

CLAIM.—" What I claim therein as constituting my invention, and desire to secure by letters patent, is the particular way in which I form the tenons on the rails, and the mortises in the posts, out of the solid material, as set forth, so that the respective parts are put together and tightened in the manner described. I also claim the manner of attaching and tightening the sacking bottom, by means of separate sacking rails, drawn up at the sides by means of thumb-screws, the sacking being at the same time stretched lengthwise by the bearing of the ends of the side-rails against the inclined planes of the end-rails; the whole constructed and operating substantially as set forth."

Improvement in Ploughs. By WILLIAM BRYANT.

CLAIM.—" What I claim as my invention, and desire to secure by letters patent, is the fixing in the plough, a coulter behind the share or cutting part, which coulter steadies the plough, and loosens the earth lower than the share cuts."

Improvement in Candlesticks. By WILLIAM CHURCH.

CLAIM.—" I desire it to be understood that I claim as one of the features of this invention of improvements in candlesticks, an elastic holder for the candle, connected to the socket, by whatever means and however formed."

Improvements in the construction of Soap-Frames.

By Joseph Bolton Doe.

Claim.—"What I claim as constituting my improvement in soap-frames, is the constructing of such frames, from metal or other material which is a good conductor of heat, in the manner herein described; that is to say, by making them in one entire frame, (in lieu of in separate frames placed over each other) and having moveable sides and ends secured together by bolts or other analogous devices, substantially as herein set forth."

Improvement in machines for removing Snow from Railroad Tracks.

By Charles Lombaert.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of dividing and removing snow on railroad tracks, &c. by means of an inclined plane, constructed with sides, as herein set forth, and of conducting the same from the machine by means of the raised platform, triangular frame, and wings *g g*, in combination with the foregoing arrangement; the whole being constructed and operating substantially as herein set forth."

Improvement in the Rocking Chair. By Samuel H. Bean.

Claim.—"What I claim as my invention and desire to secure by letters patent consists in making the seat and stool of the chair in two parts so that the seat shall rock on the top of the stool, instead of having the parts permanently united, with rockers on the legs of the stool as heretofore; and also the mode of connecting together the seat and stool by the vertical plates attached to the seat passing through the stool with shoulders projecting from the sides thereof which catch against the under side of the stool when the seat is rocked to and fro; and likewise the manner of reclining the back of the seat at any angle required by the lock plates and notches in the hanging plates which receive them as before described."

Improvement in the mode of preparing Flax and Hemp preparatory to the various processes of cleaning and separating the fibres, &c.

By Sands Olcott.

Claim.—"What I claim as *new* and as *my* invention and desire to secure by letters patent, is the shape in which I place the material to be worked, or in other words, the conversion of hemp or flax to be acted on, into an *Endless Rove or Belt*, so that it may continue to pass in and out of the machinery after the manner of a belt."

Improvement in the mode of constructing Bails and Drivers for Grist-Mills. By Ezra R. Benton.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing the bail and driver with corresponding prongs and depressions, as shown at C D C, Fig. 3, and J J J, Fig. 1, constituting a three-bearing coupling, and E F, Fig. 4, and K L, Fig.

2, constituting a two-bearing coupling, connectively shown at Figs. 6 and 7; said couplings being on a level, or nearly so, with the hemispherical depression in the centre of the bail. Thus coupling the bail and driver together, at or nearly the same distance from the face of the stone with the point of the spindle on which the stone is suspended and balanced, in the manner herein set forth. I also claim the giving the rounding or head form to the sides of the square H of the spindle, for the purpose of enabling it to move freely within the mortise G of the driver, notwithstanding any bending of the driver upon the spindle."

Improvement in the Condensing Apparatus of Steam-Engines.
By Daniel Treadwell.

Claim.—"My invention, for which I claim letters patent, consists in forming the condenser with curved pipes, as herein particularly described, which pipes pass from, and return to, the same plate, by which they are supported, and which plate covers the two cavities, into one of which the steam passes from the exhaust pipe of the engine, and the other receives the water formed by the condensed steam: this form of construction having the following advantages:—1. All the pipes are supported by the same body.—2. They are all opened to be cleaned, by a removal of the back plate.—3. They are free to expand and contract, without causing their ends to move.—4. The outside of the pipes are open and exposed, so that they can be cleaned without removing any part on which their support depends.—5. They are, by means of being secured by soldering to the plate, placed nearer together than in any other form of fixture."

Improvement in the mode of preparing White-Lead Paint.
By James N. Trovills.

Claim.—"I do not claim to be the first to have incorporated linseed oil and water together in the preparation of paint, with a view to economy in the use of the former article, this having been done by the aid of lime or other alkaline substances; but what I do claim, is the producing of this combination by the agency of white lead alone, substantially in the manner above set forth, for the purpose of producing a mixture to be employed as a paint, applicable to all the objects to which white lead is ordinarily applied."

Improvement in Steam Boilers. By Jacob B. Eversole.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, consists in placing the segment guard or partition between the flue and bottom of the boiler, so as to ward off the steam generated on the bottom of the boiler, and direct it upward, without touching the bottom of the flue, as before described."

Improvement in Machinery for Removing Stumps and other Heavy Bodies. By Miles C. Mix.

Claim.—"What I claim as my invention, is the particular manner of obtaining the power, by the construction and arrangement of the

gearing as herein set forth; that is to say, the mode of operating by two or more sets of double pinions on two differential wheels, through the intermedium and by means of an apparatus combined and connected substantially as herein set forth, for the purpose of removing stumps or other articles requiring great power, and to which such a machine is adapted."

Improvement in the mode of Oiling and Protecting Mill-Spindles from Dirt. By JESSE HUBBARD.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is the mode of protecting the spindle of the mill from meal and dirt, by means of the protection collar and groove, and of oiling the spindle by means of a hole through the damsel, bail, and driver, as herein before described."

Improvement in Brick Machines. By SAMUEL TALBOTT.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is the mode of producing the pressure on the piston E, by means of the lever H, operated by the cam J, in combination with the mode of operating the bed D, of the press for throwing up the bricks, when pressed by means of the lever L, operated by the cam K, the whole being constructed, arranged and operating as herein set forth. I also claim, in combination with the foregoing, the mode of operating the box F, and removing the bricks by the same. the box being operated by the forked lever *o*, moved by the cams *q* Q′, all as herein set forth."

Improvement in Stoves. By JOHN SCOTT.

CLAIM.—"What I claim as my invention in the above described stove, and desire to secure by letters patent, is the manner in which I have combined and arranged the hopper, the drum, and the furnace; the whole apparatus being connected and combined substantially as herein set forth."

Improvement in the self-regulating and self-oiling Mill Bush. By SAMUEL MOORE.

CLAIM.—"What I claim therein as constituting my invention, and which I desire to secure by letters patent, is the manner in which I have arranged and combined the double-faced brass boxes or oil-cups, with the nuts, studs, and springs, so as to operate upon the spindle, in the manner and for the purpose herein set forth."

Improvement in the mode of constructing Chairs for sustaining and holding the Rails for Railroads. By WILLIAM DRIPPS.

CLAIM.—"Having thus fully described the manner in which I construct my railroad chair, and shown how the same operates in producing the intended effect, what I claim therein as of my invention, and desire to secure by letters patent, is the particular combination of the respective parts thereof, constructed, formed, and operating substantially as set forth; that is to say, I claim the combination of the cheek-piece C C,

with the separate cheek-piece or casting E E, and the plate-wedge F F, producing their combined effect in the manner described."

Improvement in the mode of constructing Combined Ploughs.
By JONATHAN KNODLE.

CLAIM.—"What I do claim, is the using of several mould-boards of cast iron, of the ordinary construction of such mould-boards, but without land-sides, and the so arranging said mould-boards as that the point of either of those in the rear shall follow that which precedes it, within the width of its furrow-slice, in the manner and for the purpose herein set forth."

Improvement in Guns, Pistols, and other Fire-Arms.
By GEORGE STOCKER and JOSEPH BENTLEY.

CLAIM.—"We desire it to be understood that we do not claim all the parts which we have described in the foregoing; but what we do claim as our invention, and desire to secure by letters patent, are the following, namely:

"1. The manner in which we construct the explosion-chamber within the breech of fire-arms, or within the break-off, as set forth.

"2. The manner of constructing and arranging the cocking-lever with its lower end within the guard, said lever being combined with the other parts of the lock, as described.

"3. The manner of connecting the break-off, and the cock and trigger plates, by means of the screw, the connecting piece *w* and its appendages, substantially as set forth."

Improvement in the Breast-plate Harness for Horses. By ABEL POST.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is the improvement to the common breast-collar by my clasp in front, and by substituting hames and pads as described, in the place of the neck strap to the English breast-collar."

Improvement in the construction of Platform Balances.
By CHAUNCEY CRAIN and E. L. WEMPLE.

CLAIM.—"What we claim as our invention, and desire to secure by letters patent, is the method of balancing the levers by means of the weight K suspended from the lever I, between the pendants M M, and adjusted by the screw L, the whole being constructed and operating in the manner set forth. We claim also forming the graduated lever with a clasp, to which the moveable weight is attached with pointers, to indicate by the lines on the lever the amount of weight on the platform."

Improvement in the manner of constructing and affixing the Ribs of Saw-Gins for ginning Cotton. By ASA COPELAND, JR.

CLAIM.—"What I claim as my invention and improvement in the constructing and affixing the ribs of saw-gins for the ginning of cotton, is the so forming and affixing them to the breast or grate-fall, as that their upper ends shall stand off from the front of said breast in the

manner herein described, in order to allow of a free and uninterrupted rise and escape of the fibres and seed, from the upper ends of said ribs; and this I claim, whether the said ribs be formed and attached precisely in the manner set forth, or in any other way which is substantially the same, and by which a like result is obtained."

Improvement in the Machinery for operating Friction Brakes for Railroad Cars. By John L. Clarke.

Claim.—"First. I claim arresting or retarding the progress of cars, while in motion on a railway, by a combination of rods F, G, H, I, K, L, connected with the friction brakes by the intervention of the toggles or progressive levers *g, h, i, i, k, k,* lever *d, e, f,* transverse beam D, or other suitable machinery, the whole arranged and operating by the momentum or power applied to the lever *b', c', d,* substantially in the manner and on the principles herein above described and represented in the different drawings.

"Second. I claim the method of connecting the rod F, G, and toggles *g, h,* by means of the combination of machinery, consisting of the dog or catch, *p,' q,'* attached to the rod F, G, piece of metal *r,'* shaped and arranged together, and acting in connection with the levers *b', c', d', e', f,' g',* substantially as above described, for the purpose of operating the brakes of the tender by the momentum of the cars, whenever the same may be necessary or desirable."

Improvement in the Machine for Washing and Cleaning Yarn. By Sands Olcott.

Claim.—"What I claim as my invention, and desire to secure by letters patent is, the construction of a machine for washing yarn and other substances, by means of a series of pairs of fluted rollers, with flanges on one of each pair, in combination with the reservoir and trough, so that an endless skein can be passed continually through them, and at the same time be passing through the water or other liquid for washing, as herein described."

Machine for reducing the Fibres of Flax and Hemp. By Sands Olcott.

Claim.—"What I claim as my invention, and desire to secure by letters patent is, the combination of the gang of saws or rows of teeth on a cylinder, with the arrangement of cords and rollers for holding, guiding and working the flax or hemp in the manner herein described."

Improvement in the Floating Swing-Bridge. By John N. Vrooman.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a boat, float, scow or buoy, for the purpose of sustaining the swinging end of a bridge in the manner described. I also claim the arrangement of ropes or chains, by which the bridge can be opened or closed from either side of the canal or stream, as described, and in combination therewith, the latch for retaining the bridge in its place when thrown back, as described."

Improvement in the method of Oiling Horizontal Shafts and Axles.
By Hiram M. Smith.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the wheel B, working in an oil-cup, and in a sliding frame or gate, acted upon by a spring, which adapts itself to any irregularity of height the bearing is subject to, as herein described. I disclaim it as a friction roller, as I do not intend it to support the bearing, but merely to act as an oiler or feeder. I also claim the wiper and the gutters on each side of the bearing, in combination with the wheel, as herein described."

Improvement in the manner of manufacturing Screw Augers.
By William Field.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the forming the twist in screw-augers by means of swages or dies, constructed and operating substantially as herein set forth."

Improvement in Cheese Presses. By Rufus Porter.

Claim.—"I claim as original, the mode of producing a pressure by means of the double levers, friction rollers, and swelled posts, as above described."

Improvement in Bee-Hives. By Martin Engel.

Claim.—"What I do claim as my invention, and desire to secure by letters patent, is the manner in which I have combined and arranged the two inclined traveling planes, *b* and *d*, and the strips *g*, fig. 4, for the entrance of the bees, so as to form the abrupt turn, as shown in the drawings. I claim, in combination with said entrance, the closing slide *i*, shown in fig. 4. I claim also the manner of constructing and using the sliding frames, fig. 3, with their vertical rods, climbing or building sticks; and also the constructing of the horizontal grates in the manner and for the purpose set forth."

Improvement in Tailors' Measuring Instruments.
By William J. Lemmond.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, consists in the combination of the horizontal graduated sliding strap No. 2, having graduated vertical sliding straps No. 4 upon it, with tape measures attached to them, with the graduated vertical strap B, and also the combination of the graduated horizontal strap No. 3, having vertical sliding pieces No. 5, with tape measures, attached to them with the vertical strap B; the whole being constructed and operating in the manner and for the purpose described."

Improvement in the mode of measuring and drafting Garments.
By Isaiah J. Hendryx.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of obtaining the backward or forward location

of the shoulder-strap and pitch of the shoulder seam, by means of a flexible square and protractor, applied and used in the manner herein set forth."

Improvements in the construction of Railroads. By JAMES HERRON.

CLAIM.—"What I claim as my invention, and desire to secure by letters patent, is:

"1. Placing the sills *a c a* and *b c b*, &c. Fig. 1, &c., A and B Fig. 29, 33 and 43, in the formation of a railway, so that they will cross each other in lines diagonal to the rail; and uniting them with each other and with the rails, so that they become struts and tie-braces to the track, substantially as set forth. And whereas, said brace-sills may be variously combined with each other, and with cross-sills, as at Figs. 33 &c., 44 &c., and 46 &c., and may be made to support an iron rail without the intervention of the timber string-pieces; and may also, like common sills, be placed on a 'mud sill.' I distinctly claim to be the inventor of the *braced sill*, or *latticed construction* of *railway* tracks, under the modifications set forth, together with such variations thereof as may produce a like result by means substantially the same. I thus, by the union in one, to an indefinite extent, of such materials as those that usually compose railway tracks, obtain by a united framing a more extensive and uniform bearing on the soil, than the individual parts would have; all other railways having to depend on the uniformity of soil, or artificial road-bed, for their evenness of surface. Whereas my railway track, herein before described, is independent in its formation of the soil on which it rests.

"2. The method of uniting or scarfing the string-pieces, substantially as represented at A and B, Figs. 1 and 2, &c., and in Figs. 33 and 34, sheet 4th. And whereas said scarf can be used with great advantage to unite the ends of large timbers in foundations, piers, bridges, and other structures, I distinctly claim its application to the general purposes of carpentry.

"3. The method of evenly joining and holding railway bars by means of a *metallic spring pressure*, so as to permit the contractile and expansive motion of the railway bar, whether said spring-pressure operates by means of my malleable iron 'chains' described, or as it may be variously modified and united with cast-iron 'chains,' as herein described. The application of a spring to the rail for the purpose described, being in itself new; and as said spring may be variously applied for producing the intended effect, it is to be distinctly understood that I claim the employment of a spring under the various modifications thereof described; and whenever it operates upon the principle and produces the effect in the manner set forth.

"4. The method of holding the iron rails at the middle of their lengths, as set forth and represented in Figs. 17, 18, and 19; also, in Figs. 29, 30, and 32, and in 33, 34, and 35; by which the iron rail is made to support the scarf of the string-pieces, or to form a part of the splice, as herein before described."